NAVY MANTECH
Manufacturing Technology Program

... bridging the affordability gap

2009 Navy ManTech Project Book

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ONR
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2009 Navy ManTech Project Book: This 2009 edition of the Navy ManTech Project Book provides brief write-ups for each of the Navy ManTech projects active in FY08. To highlight the Navy ManTech Investment Strategy with its concentration on a few key platforms, the projects are organized by platform or, where it makes sense, by organization. Please feel free to contact any of the Points of Contact listed in the project write-ups for additional information on any Navy ManTech project.

Projects by Platform:

The Navy ManTech Program provides for the development of enabling manufacturing technology and the transition of this technology for the production and sustainment of Navy weapon systems to support the Fleet. Navy ManTech is currently focused on shipbuilding affordability. Reducing the acquisition cost of current and future platforms is a critical goal of the Navy, and ManTech aids in achieving this goal by developing, maturing, and transitioning key manufacturing technologies.

Transition of technology is key to Navy ManTech success. Advances in manufacturing technology are useful to the Navy only if they result in implementation in the production of weapon systems. Transition of manufacturing processes to private and government industrial entities that manufacture and repair systems and components for the Fleet is the goal of every ManTech project.

The Navy ManTech Program works with defense contractors, the Naval Research Enterprise, Navy acquisition Program Offices, and academia to develop improved processes and equipment. The Program is structured to provide maximum dissemination of the results of ManTech projects and to promote early implementation to strengthen the defense industrial base. With their expertise in specific technology areas, the Navy ManTech Centers of Excellence (COEs) play a key role in the definition and execution of the Navy ManTech Program. The customers of the Navy ManTech Program range from the acquisition Program Managers (PMs) and industry responsible for transitioning major Navy weapon systems from development into production, to the logistics managers at the naval depots and shipyards responsible for repair, overhaul, and remanufacture of major weapon systems. Additional beneficiaries of the Navy ManTech Program include the other Services and academia.

The Navy ManTech Program is managed by the Office of Transition within the Office of Naval Research (ONR), with direct oversight from the Chief of Naval Research. With the transition of technologies to the Fleet and acquisition as top priorities, ONR's Office of Transition is composed of transition-centric programs including ManTech, Future Naval Capabilities (FNCs), the Small Business Innovation Research (SBIR) / Small Business Technology Transfer (STTR), and other transition initiatives.

The Department of Defense (DOD) ManTech Program, managed by the Office of the Deputy Under Secretary of Defense, Advanced Systems and Concepts, has oversight of the ManTech programs of the Services and the Defense Logistics Agency (DLA). These organizations, together with the Missile Defense Agency (MDA), coordinate their programs through the auspices of the Joint Defense Manufacturing Technology Panel (JDMTP), consisting of the ManTech directors of the Services, DLA, and MDA with advisory representation from the Office of the Secretary of Defense (OSD), the Department of Commerce's National Institute of Standards and Technology (NIST), the Department of Energy, and industry. The JDMTP is organized to identify and integrate requirements, conduct joint program planning, and develop joint strategies.

The objective of the Navy ManTech Program is to significantly improve the affordability and improve mission capability of Department of the Navy (DoN) systems by engaging in manufacturing initiatives that address the entire weapon system life cycle and that enable the timely transition of technology to industry to support the Fleet.

More specifically, DOD Directive 4200.15 states that ManTech investments shall:

1. Aid in the economical and timely acquisition and sustainment of weapon systems and components.
2. Ensure that advanced manufacturing processes, techniques, and equipment are available for reducing DOD material acquisition, maintenance, and repair costs.
3. Advance the maturity of manufacturing processes to bridge the gap from research and development advances to full-scale production.
4. Promote capital investment and industrial innovation in new plants and equipment by reducing the cost and risk of advancing and applying new and improved manufacturing technology.
5. Ensure that manufacturing technologies used to produce DOD material are consistent with safety and environmental considerations and energy conservation objectives.
6. Provide for the dissemination of Program results throughout the industrial base.
7. Sustain and enhance the skills and capabilities of the manufacturing workforce, and promote high levels of worker education and training.
8. Meet other national defense needs with investments directed toward areas of greatest need and potential benefit.

Navy ManTech: Bridging the Affordability Gap by —

- Focusing resources on key, high-priority acquisition platforms
- Targeting cost reduction as the primary benefit
- Developing critical manufacturing and repair/sustainment solutions
- Engaging relevant industry partners up-front and throughout the process
- Targeting ManTech transition and platform implementation as the key measures of success

The Navy ManTech Program Investment Strategy concentrates ManTech investments on key Navy acquisition programs. The present emphasis is on addressing the critical Navy goal of reducing the acquisition cost of current and future platforms. Beginning in 2006, ManTech adopted a shipbuilding affordability investment strategy. Platforms for investment are determined by total acquisition funding; stage in acquisition cycle; platform cost reduction goals; cost reduction potential for manufacturing; and other factors primarily associated with the ability of ManTech to deliver the technology when needed. ManTech investments are currently focused on affordability improvements for four major acquisition platforms: DDG 1000, CVN 21, the Littoral Combat Ship (LCS), and the VIRGINIA Class Submarine (VCS). ManTech is helping these four programs achieve their respective affordability goals by transitioning needed manufacturing technology which, when implemented, results in a cost reduction or cost avoidance (measured as $/hull) for these key platforms.

Strategic planning for Navy ManTech is an ongoing effort. Navy ManTech annually analyzes acquisition scenarios and plans to determine major acquisition programs for potential investment. As the current ManTech platforms mature through their acquisition cycles, ManTech's investment targets will change.

Navy ManTech projects are developed in conjunction with industry and the acquisition Program Manager (PM). Planning for transition prior to the initiation of projects is critical for the implementation of technology on the factory floor and eventually into the Fleet. The Program Executive Offices (PEOs), PMs, and relevant industry partners are encouraged to participate in an initial concept exploration phase – an assessment of the manufacturing processing needs of the weapon system. Most importantly, this includes the determination of whether the ManTech projects have a high likelihood of successful completion in time to meet the "window of opportunity" for insertion into the weapon system. Balanced with ManTech's available resources, highest priority manufacturing opportunities are selected.

Agreements are also reached on the degree of participation of the PEO/PM in support of the projects. The goal is for each PEO/PM to contribute resources to enable successful completion and implementation of the ManTech projects. Resources supplied may include financial support or cost share for the ManTech project itself or funding of Navy laboratory personnel to provide test, evaluation, certification, and/or other services. In addition, each PEO/PM is expected to provide personnel with technical expertise and/or management experience to assist the ManTech Program Office in project oversight. This support affords assurance that the weapon system PM is truly committed to the successful outcome of the ManTech project. In addition, this close working relationship between the parties provides ManTech with a longer-term view of implementation.

To clarify communication between program participants, Navy ManTech has established definitions for "transition" and "implementation" and has instituted the development of a Technology Transition Plan for each project that is signed by Navy ManTech, the COE Director, Industrial Facility Management, the Program Office and, if appropriate, the Technical Warrant Holder.

For Navy ManTech purposes:

- Transition denotes that point at which the ManTech project is completed and the technology meets customer (Program Office / industry) criteria / goals for implementation.
- Implementation denotes the actual use on the factory floor of ManTech results. (The resources for implementation are typically provided by entities other than ManTech including the Program Office and/or industry).

ManTech, alone, cannot ensure implementation, but a well-defined Technology Transition Plan assists the Program Office and Industrial Facility Management in supporting the transition and in resourcing and achieving implementation. In addition to increased involvement from the PM customer, ManTech engages key industry partners early in the development cycle and continues to keep industry involved throughout. Focused initiative integrated project teams (IPTs) keep communication lines open among the PM, Navy ManTech, the COEs, and industry to ensure that projects complete in time to meet the "window of opportunity" for implementation. Projects whose implementation opportunities have been lost are terminated. Thus the Navy ManTech Program ensures that resources are focused on those projects with high implementation probability.

Technology roadmaps have been developed for all four currently supported ship platforms. Components of current roadmaps include: (1) acquisition schedule – as identified in the Feb 2008 Navy Revised 30 Year Shipbuilding Report to Congress; (2) shipbuilding requirements - garnered from ship acquisition Program Offices, industry, and the National Shipbuilding Research Program (NSRP) Strategic Plan which identifies common shipyard process deficiencies; (3) Navy ManTech Focus Areas; and (4) Navy ManTech financials – funding and anticipated cost reduction. These roadmaps are shared with both the platform Program Offices and the relevant industry to ensure that Navy ManTech is investing in the highest priority areas for that particular platform.

To understand and assess progress towards meeting both platform and ManTech affordability goals, Navy ManTech has instituted an affordability assessment effort which identifies cost avoidance / savings per project, as well as estimated total savings per platform. An initial assessment was conducted in July of 2007. An update, to the initial assessment occurred in the 2Q FY08.

While the large majority of yearly ManTech Program resources are invested in accordance with the shipbuilding affordability investment strategy, Navy ManTech does support smaller efforts in Energetics, Repair Technology (REPTECH), and Benchmarking and Best Practices.

Energetics: Energetics ManTech projects develop and transition process technologies for the synthesis of new or improved energetic materials, improved manufacture of propellants and explosives, and improved handling and loading of energetic materials into systems and components. Concentration is on developing solutions to ensure the availability of safe, affordable, and quality energetics products in support of Program Executive Offices such as Integrated Warfare Systems (PEO IWS/IWS3C) and Conventional Strike Weapons (PEO (W)/PMA 201). More information on Navy ManTech's Energetics Manufacturing Technology Center (EMTC) can be found on Page 11.

REPTECH: While the major emphasis of the Navy ManTech Program is on support of new production, ManTech also addresses repair, overhaul, and sustainment functions that emphasize remanufacturing processes and advancing technology. The REPTECH Program focuses on fielded weapon systems and provides the process and equipment technology needed for repair and sustainment. Requirements for REPTECH projects are driven by Navy depots, shipyards, Marine Corps Logistics Bases, intermediate maintenance activities, and contractor facilities responsible for overhaul and maintenance of fleet assets. In general, REPTECH projects are usually shorter in duration and are funded at lower levels than standard ManTech projects. The REPTECH Program is run by the Institute for Manufacturing and Sustainment Technologies (iMAST). More information can be found on Page 12.

Benchmarking and Best Practices: In 1985, Navy ManTech began funding efforts to identify, validate, and disseminate Best Manufacturing Practices used in government, industry, and academia. Today, the Benchmarking and Best Practices Center of Excellence (B2PCOE) is a Navy and DOD resource for sharing best practice standards for mature manufacturing technologies, stable and producible designs, and mature production processes. The B2PCOE maintains strategic partnerships with academic organizations, industry, and government across all technology disciplines that impact Navy and DOD platforms and weapon systems. More information on the Navy ManTech's B2PCOE can be found on Page 8.

The Navy ManTech Program executes its projects primarily through its COEs. The COEs were established as focal points for the development and transition of new manufacturing processes and equipment in a cooperative environment with industry, academia, and the Naval Research Enterprise.

The COEs:

- Execute projects; manage project teams
- Serve as corporate expertise in technological areas
- Collaborate with acquisition program offices / industry to identify and resolve manufacturing issues
- Develop and demonstrate manufacturing technology solutions for identified Navy requirements
- Provide consulting services to Naval industrial activities and industry
- Facilitate transfer of developed technologies

Descriptions of ManTech's nine COEs are presented below.

Benchmarking and Best Practices Center of Excellence

The Benchmarking and Best Practices Center of Excellence (B2PCOE) mission is to identify, validate, and disseminate best in-class practices, processes, methodologies, systems, and best practice technologies with the end objective of improving the level of competitiveness of the defense industrial base and the affordability and performance of defense platforms and weapon systems. The B2PCOE vision is to be a Navy and Department of Defense resource for sharing best practice standards for mature manufacturing technologies, stable and producible designs, and mature production processes.

Operated by the American Competitiveness Institute in Philadelphia, PA, the B2PCOE identifies, validates, and disseminates best practice standards by formally integrating each ManTech Center of Excellence, small businesses, academia, and industry; and thus fostering high levels of horizontal communication and collaboration. The B2PCOE maintains strategic partnerships with academic organizations, industry, and government across all technology disciplines that impact Navy and DOD platforms and weapon systems.

B2PCOE Web site: www.dodb2pcoe.org

Center for Naval Shipbuilding Technology

The mission of the Center for Naval Shipbuilding Technology (CNST) is to identify, develop, and deploy in U.S. shipyards, advanced manufacturing technologies that will reduce the cost and time to build and repair Navy ships. The Center works closely with the Navy's acquisition community and the shipbuilding industry to identify manufacturing technology issues that negatively impact shipyard efficiency, both with respect to cost and cycle time. CNST solicits, selects, and funds projects to address these critical and costly issues. The projects are focused on improving major ship construction and repair processes, such as optimizing production processes, predicting and reducing weld distortion, developing more efficient structural fabrication product lines, increasing the use of robotic welding methods, and eliminating inefficiencies in training, material usage, and supply chain procedures.

Operated and managed by Advanced Technology Institute ATI in Charleston, SC, CNST is pursuing projects focused on improving the affordability of current Navy acquisition programs, specifically VIRGINIA Class submarines, FORD Class aircraft carriers, ZUMWALT Class destroyers, and the Littoral Combat Ship. New projects being considered include investigating the use of adhesives for mounting lightweight outfitting items, developing smart manufacturing methods for composite structures, implementing a mobile hybrid laser welding system, installing state-of-the-art hull accuracy control tools, improving shipyard-wide parts marshalling, and improving outfitting practices.

CNST Web site: http://www.cnst.us

Composites Manufacturing Technology Center

The Composites Manufacturing Technology Center (CMTC), established in 2000, is located in Anderson, SC, and is operated by the South Carolina Research Authority (SCRA). The CMTC is consortium-based with a balanced membership providing expertise to address all Navy composites manufacturing technology needs. The Composites Consortium (TCC) membership includes prime contractors, composites industry suppliers, and universities. TCC has strong, in-depth knowledge and experience in composites manufacturing technology for all modern DOD weapon systems. As part of CMTC's organizational structure, all laboratories, facilities, and project labor resources are provided by project teams assembled from consortium members. This unique structure results in cost benefit to the Navy, with maximum funding going to project execution. CMTC's current portfolio includes composites manufacturing projects for manned and unmanned aircraft, surface ships, submarines, missiles, and land vehicles.

CMTC Web site: http://cmtc.scra.org

Electro-Optics Center

The Penn State University Electro-Optics Center (EOC) was established in 1999 as the Navy's Center of Excellence for Electro-Optics. The center, located in Freeport, PA, utilizes two facilities with a total of 63,000 square feet of laboratory and office space. The vision of the EOC is to be the national resource for the advancement of electro-optics and related technology for the primary benefit of national security.

The mission of the EOC is to:

- Provide the best and latest electro-optic (E-O) technologies for the United States warfighter and national security interests
- Partner with government, industry, universities, and nonprofit organizations
- Conduct basic and applied research and technology demonstrations that add to the greater capabilities of the technology field through resident expertise and collaborations
- Seek out and facilitate technology transfer leading to the commercialization of E-O and related technologies
- Expand the current and prospective workforce through education and outreach
- Provide effective project and program management and knowledge of the government acquisition process.

The EOC is supported by the Electro-Optics Alliance, a growing consortium of 400+ industrial, government, non-profit, and academic organizations that share their E-O expertise and capabilities through project teams focused on Navy and DOD requirements. The purpose of the Alliance is to advance DOD critical E-O Manufacturing Science and Technology and to promote U.S. preeminence in all areas of E-O. Alliance membership is available at no cost to all U.S. companies, government labs, and academic institutions involved in E-O technology. The Alliance is committed to advancing the commercial viability of E-O technologies and promoting technology transfer to industry, as well as wide dissemination of new E-O related information. U.S. organizations with capabilities in E-O science and technology are encouraged to join the Alliance by visiting the EOC Web site and completing a membership application.

EOC Web site: http://www.electro-optics.org

Electronics Manufacturing Productivity Facility

The Electronics Manufacturing Productivity Facility (EMPF) was established in 1984 to aid the electronics industry in improving electronics manufacturing processes required in the manufacture of military systems. Today, the EMPF operates as a national electronics manufacturing COE focused on the development, application, and transfer of new electronics manufacturing technology by partnering with industry, academia, and government centers and laboratories in maximize available research capabilities at the lowest possible cost. The EMPF serves as a corporate residence of expertise in electronics manufacturing. The EMPF's principal goals are to: improve responsiveness to the needs of DOD electronics systems; ensure that deliverables make a significant impact in the electronics manufacturing industry; facilitate the development and transition of technology to the factory floor; and expand the customer base to a national level.

The EMPF operates in a modern 36,000 square foot facility adjacent to the Philadelphia International Airport. The facility houses a demonstration factory containing the latest electronics manufacturing equipment, fully equipped classrooms for skill-based and professional level technical training, and an analytical laboratory for materials and environmental testing. The EMPF offers many electronics manufacturing services and capabilities to the U.S. Navy, DOD, and the U.S. electronics manufacturing industrial base. The EMPF's resident technical staff consists of the nation's leading electrical engineers, mechanical engineers, materials scientists, chemists, physicists, instructors, and technicians. The EMPF staff is dedicated to the advancement of environmentally safe electronics manufacturing processes, equipment, materials and practices; flexible electronics manufacturing technologies; and workforce competency in advanced electronics manufacturing.

EMPF Web site: http://www.empf.org

Energetics Manufacturing Technology Center

The Energetics Manufacturing Technology Center (EMTC), established in 1994, is Navy operated and located at the Naval Sea Systems Command's Naval Surface Warfare Center (NSWC), Indian Head Division, Indian Head, MD. A renowned leader in energetics, the Indian Head Division serves as the focal point for this group and provides a full spectrum of capabilities including energetics research, development, modeling and simulation, engineering, manufacturing technology, production, test and evaluation, and fleet / operations support.

Energetic materials (reactive chemicals), formulations (propellants, explosives, pyrotechnics), and subsystem components (fuzes, detonators, boosters, igniters, safe and arm devices) are critical to the performance and reliability of weapon systems as well as to our Nation's defense. Applications include missile, rocket, and gun propulsion; stores or ordnance separation; warheads and munitions; obstacle and mine clearance; flares; decoys; fire suppression; and aircrew escape. Energetics, inherently dangerous, require special processes, equipment, facilities, environmental considerations, and safety precautions. At EMTC, this is kept in mind while ensuring the availability of safe, affordable, and quality products.

The Center develops solutions to manufacturing problems unique to military system / subsystem acquisition and production requirements and the energetics industry.

The Center does not own or operate any facilities and equipment but is essentially a virtual enterprise that involves government, industry, and academia in identifying requirements and executing projects. EMTC objectives are to identify weapon system and manufacturing base needs, develop and demonstrate the required manufacturing process technology solutions, and finally transition successful results.

EMTC Web site: http://www.ih.navy.mil/Directorates/cao/emtc/index.asp

Institute for Manufacturing and Sustainment Technologies

The Institute for Manufacturing and Sustainment Technologies (iMAST), established in 1995, coordinates Navy ManTech efforts at The Pennsylvania State University's Applied Research Laboratory (ARL), one of four U.S. Navy University Affiliated Research Centers (UARCs). Located in State College, PA, iMAST's primary objective is to address challenges related to Navy and Marine Corps weapon system platforms in the following technical areas: mechanical drive transmission, materials processing, laser processing, advanced composites, manufacturing systems, repair and sustainment, and complex systems monitoring. iMAST supports the Navy and Marine Corps systems commands, as well as PEOs and Navy laboratories.

REPTECH applies new and emerging technologies to improve capabilities of Navy depots, shipyards, Marine Corps Logistics Bases, and lower level maintenance activities throughout the Fleet. REPTECH cooperates and communicates with Navy COEs, the joint depot community, DOD industrial activities, industry, PEOs, and university laboratories.

iMAST Web site: http://www.arl.psu.edu/capabilities/mm_imast.html

Navy Joining Center

The Navy Joining Center (NJC) was established in 1993. The Center is operated by Edison Welding Institute (EWI) and is located in Columbus, OH.

Materials joining is a primary means of fabricating and maintaining the fleet, aircraft, weapons, and the advanced electronics that are the core of modern Navy forces. Implementing the best materials joining technologies is critical to improving the performance of Navy weapon systems and increasing the productivity of manufacturing practices needed to reduce the acquisition costs of these systems. The NJC provides a national resource for the development of materials joining expertise and the deployment of emerging manufacturing technologies to Navy contractors, subcontractors, and other activities. The NJC team represents a collaborative effort among industry, academia, and government and is experienced in identifying joining problems, developing and deploying solutions, and transferring technology.

The NJC disseminates project results and other joining information through demonstrations, workshops, conferences, publications, and a Joining Technology Information network. Typical projects provide joining solutions for metallic, non-metallic, ceramic, and composite materials that support Navy ManTech strategic plans.

NJC Web site: http://www.ewi.org/njc

Navy Metalworking Center

The Navy Metalworking Center (NMC) is the national resource for the development and transition of advanced metalworking and manufacturing technologies, materials and related processes. Established in 1988 to address Navy and DOD metalworking needs, NMC works in partnership with government, industry, weapon systems prime contractors, and Program Offices to develop and apply innovative technologies. NMC drives new technologies from research and development to naval weapon systems application with two objectives: 1) to implement new technologies that will improve weapon system performance; and 2) to develop new production means for weapon systems prime contractors and suppliers that lower the production cost of naval weapon systems.

For twenty years, NMC has supported the Navy with affordable new metalworking technologies and capabilities that have responded to increasingly stringent requirements for greater agility, survivability, and lethality. NMC is operated by Concurrent Technologies Corporation, an independent, nonprofit organization located in Johnstown, PA.

NMC Web site: http://www.nmc.ctc.com

Artist's rendering of CVN 78, the new Ford Class carrier.

As previously indicated, the emphasis of the Navy ManTech Program is on transition of manufacturing technology that will result in tangible benefits for the fleet. To achieve transition, it is imperative that the manufacturing advances be widely disseminated to the industrial base for implementation. To foster that dissemination, Navy ManTech provides the following:

Program Web Site

The **Navy ManTech Program Web site** can be accessed at http://www.onr.navy.mil/sci_tech/3tmantech/. The Web site is a central source for accessing general information about the program, program activities and participation, developments and events, and key points of contact. The site also offers links to the online annual Navy ManTech Project Book, program success stories, as well as other publications and reports.

Defense Manufacturing Conference

The annual **Defense Manufacturing Conference (DMC)** is a forum for presenting and discussing initiatives aimed at addressing DOD manufacturing technology and related sustainment and readiness needs. The conference includes briefings on current and planned programs, funding, DOD initiatives, and seminars relating to the various technology thrusts currently being pursued. Further details are available at the DOD Manufacturing Technology Web site at: https://www.dodmantech.com.

Project Book

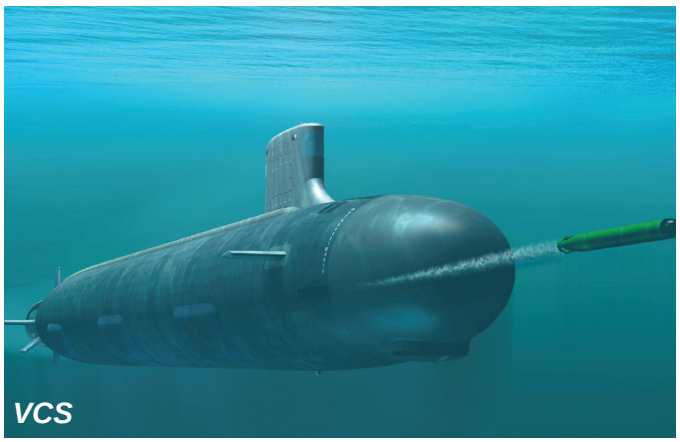
The **Navy ManTech Project Book**, published annually and available through the Navy ManTech Web site, is a snapshot of Navy ManTech projects active during that particular fiscal year. Points of contact for each project are provided to facilitate technology transfer.

Centers of Excellence

The **Navy COEs** are focal points for specific manufacturing technology areas. The charter for each COE requires it to act as a consultant to both the Navy and industry and to facilitate the transfer of technology throughout the industrial base.

The Navy urges government activities, industry, and academia to participate in its ManTech Program as participants, advisors, consultants and, most importantly, as beneficiaries. The goal of developing and implementing new and improved technologies will be achieved only through a concerted effort by everyone connected with the design, manufacture, and repair and sustainment of naval weapon systems.

For additional information on any of the projects detailed in the 2009 Navy ManTech Project Book, please contact the Point of Contact listed in the project write-up.



The four major acquisition platforms (DDG 1000, CVN 21, VCS, and LCS) that ManTech focuses on for affordability. Graphics courtesy of PEO (Ships), PEO (Subs), and PEO (Carriers).

An Up-Close Look at Navy ManTech's VIRGINIA Class Submarine Affordability Initiative

Extensive interaction and cooperation between Navy ManTech, Navy ManTech COEs, General Dynamics Electric Boat, Northrop Grumman Shipbuilding, PEO (Subs), and the PMS 450 Program Office has resulted in a focused ManTech initiative that is now successfully transitioning and implementing technology. To aid in the Navy's and industry's common goal to reduce the cost of the VIRGINIA Class submarine (VCS) from $2.4B to $2.0B (FY05 $) to allow for the construction of two submarines per year in 2012, Navy ManTech is investing in a number of areas to improve VCS affordability. These include: advanced welding and joining processes; outfitting process improvements; design for production process improvements; material management; schedule compression; and improved materials and processes. Project success is measured by implementation of these technologies on the factory floor.

The current ManTech portfolio contains over 50 active or pending projects focused on VIRGINIA Class manufacturing technology priorities with a planned ManTech investment of approximately $39 million. This current portfolio has a potential total cost savings of approximately $27M per hull for a return on investment in less than two hulls.

To date, seven of the ManTech affordability projects have completed and are in some phase of implementation. Realized cost savings/hull of $6.5M have been recognized by the VIRGINIA Class Program Office and General Dynamics Electric Boat. These real acquisition cost savings are being negotiated into the Block III VIRGINIA Class procurement, and a process has been established to achieve further savings during future submarine acquisition processes.

Projects that have been implemented or that have implementation plans approved to date include:

- **Ultra-light Welding Systems –** A commercial welding equipment manufacturer was utilized to develop a small, portable gas-metal-arc welding system which improves welder efficiency by reducing setup time.
- **Composite Main Ballast Tank Grates –** Main ballast tank grates are made of steel that are subsequently coated with a vulcanized rubber compound. An E-glass composite design was developed and manufactured as an acquisition and in-service cost-reduction option. Two replacement composite grates have been manufactured and are being evaluated under a PMS 450 SHIPALT. There are 19 grates in a VIRGINIA Class shipset.

- **Laser Image Projection –** This project demonstrated that laser image projection technology can successfully automate layout processes and significantly reduce the labor hours and span times by drastically reducing the use of paper templates and string measurements typically used for locating attachments and penetrations. The system automates the layout of attachments during early outfitting stages by enabling production workers direct access to the CAD model information needed to locate and mark points of attachment.
- **Product Centric Facility Design –** A design for a new structural fabrication facility, optimized for fabricating all types and sizes of structural components, was developed. Additionally, the project developed methods to assess structural welds in large subassemblies to determine which welds are potential robot-welding candidates.
- **Material Management –** The project focused on reducing the costs associated with warehousing, transportation, and rework of materials. Particularly important to the successful conclusion was the use of automation as well as modeling and simulation to improve efficiencies of the distribution systems.
- **Composite Sail Cusp –** A submarine sail cusp is a stiffened-steel structure comprised of numerous pieces which are welded together, filled with syntactic foam, and welded to the sail and hull structure. The ManTech project was successful in demonstrating acquisition cost savings by enabling the fabrication of the sail cusp as a one-piece, unstiffened, monocoque composite structure, bolted to the sail and hull. A suitable design has been developed and implementation is planned for the SSN 784 hull.

From RDML David C. Johnson, the VIRGINIA Class Program Manager:

> *The ONR ManTech Program is playing a significant role in the VIRGINIA Class submarine cost-reduction effort by allowing the program to investigate an unusually wide range of cost-saving, manufacturing technologies. ManTech contributions have already facilitated solutions with real cost savings on the upcoming Block III contract, and its portfolio of current projects and proposed tasks . . . are expected to continue to provide significant cost reductions on future contracts. PMS 450 is appreciative of the strong support from the Office of Naval Research and will work aggressively to transition and implement manufacturing technology improvements.*

Navy ManTech is pleased with the successful project implementations and associated cost savings resulting from the strong partnership Navy ManTech has formed with the VIRGINIA Class Program Office and the submarine industrial base. Navy ManTech looks forward to building on these successes and continuing to develop and transition key manufacturing technology improvements to make a significant impact to the VCS cost reduction effort.

Sailors "man the ship" and officially bring the VIRGINIA Class nuclear attack submarine USS North Carolina (SSN 777) to life during her commissioning ceremony. U.S. Navy photo by Mass Communication Specialist 3rd Class Kelvin Edwards (Released)

CVN 78 Projects
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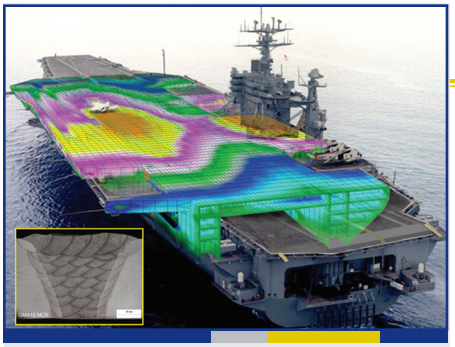
NAVY MANTECH
Manufacturing Technology Program

CVN 78 Projects

Welding Development Enables Enlarged Flight Deck and Overall Cost Avoidance



PERIOD OF PERFORMANCE:

May 2004 to September 2008

PLATFORM:

CVN 78

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

NJC

POINT OF CONTACT:

Mr. Lawrence E. Brown
(614) 688-5080
lbrown@ewi.org

STAKEHOLDER:

PMS 378

TOTAL MANTECH INVESTMENT:

$1,291,000

S2022 — Welding Development for High Strength Steel

Objective

Steel with increased strength has the potential to replace the currently used High-Strength Low-Alloy (HSLA-100) steel for selected applications and reduce the weight of CVN 78. However, further development is needed on the steel itself and on the fabrication technologies that Northrop Grumman Shipbuilding – Newport News (NGSB-NN) will use for ship construction. Welding is one of these needed fabrication technologies. The Navy Metalworking Center (NMC) is leading the overall steel development project. As a subtask to that activity the Navy Joining Center (NJC) is leading the weld development activity.

Steel development efforts have shown that the most feasible means of achieving the weight reduction and performance goals is to modify the processing of HSLA-100 steel to produce steel with minimum yield strength of 115 ksi (HSLA-115). The objectives of the NJC project are to develop welding procedures to increase productivity for fabrication of HSLA-115 steel while meeting the undermatching weld metal performance requirements. Development has focused on optimized welding electrodes and procedures to produce welds with requisite yield strength, ductility, and toughness at minimum cost.

Payoff

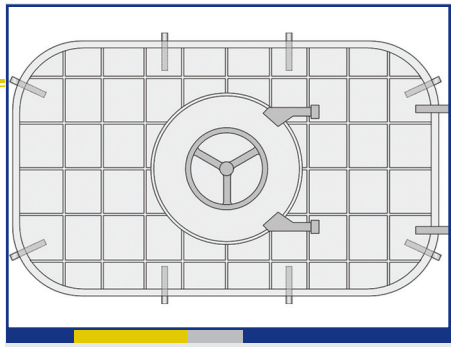
Weld development for the HSLA-115 high-strength steel will enable reductions in thickness of the flight and gallery decks. This corresponds to approximately 120 long tons of weight reduction and a lower center of gravity. The reduced weight for an enlarged flight deck will result in a 15% increase in sortie rates for this carrier class. A secondary benefit from the project will be total ownership cost avoidance due to the development of efficient and productive welding procedures which will minimize the fabrication costs for this new steel and will reduce the learning curve for shipyard implementation. Further details of payoff metrics are not available at this time for release outside the project team. The technology developed during this project also has applications on other Navy ships.

Implementation

The implementation plan is structured to satisfy the design and construction schedule requirements for the production of CVN 78. The project supports the Material Selection Information (MSI) documentation and requirements. The Integrated Project Team includes PEO (Carriers) and NGSB-NN to facilitate successful implementation of the technology developed during this project to the Navy and to the shipyard.

New Watertight Door Design Provides 27% Weight Savings

S2031 — Advanced Surface Ship Watertight Enclosures



Objective

Navy standard watertight doors (NSWDs), designed in the early 1950s, are expensive to install and maintain and are too heavy for today's needs. Installation costs are about $8,400 per door, and watertight doors are usually at or near the top of the Navy's Top Management Attention (TMA) list for hull, mechanical, and electrical (HM&E) systems requiring frequent maintenance due to poor functioning, corrosion, and loss of water-tightness. To maximize substitution opportunities on the CVN 79 hull of the FORD Class Carrier, this project focused on the 26 inch x 66 inch, 10 lbs per square inch interior door, weighing 292 pounds, with eight latching dogs and a 6-inch diameter window. The objective was to specify a new interior watertight door featuring improvements over the NSWD and incorporating advances in materials, design, and manufacturing processes including, but not limited to: stainless steels, cellular sandwich panels, a novel compliant seal and latching mechanism, distortion-reducing plug-in-hole installation, and highly accurate, high-speed, automated laser cutting and welding processes. Tasks were added in FY07 with the objective of decreasing cost.

Payoff

The new door weight was 213 lbs, which represented a 27% reduction, as compared to the NSWD, a savings of about 17 long tons per carrier. Reducing the weight of the doors allows increased alternate weight allocation opportunities for armor, ordinance, cargo, and other warfighting-related functions, while maintaining stability. Reduced installation and maintenance costs due to low distortion plug-in-hole installation, and the use of a more corrosion-resistant material (304 stainless steel) than the low carbon steel (A-36) used in the NSWD, combined with reasonable manufacturing costs, resulted in a reduction of total ownership costs, providing more resources for the warfighter. The reduction in maintenance time and cost is estimated at about 80% resulting in estimated annual cost savings of over $200K per year.

Implementation

The new door has been fabricated at Penn State University's Applied Research Laboratory (ARL) and by external manufacturers who provide doors for a testing program that includes hydrostatic, shock and cyclic testing. Northrop Grumman Shipbuilding (NGSB) is documenting the installation process and investigating methods for reducing costs. Manufacturing specifications for an optimized design of an interior watertight door for the CVN 79 has been delivered to PMS 378. On this project, ARL Penn State University's Institute for Manufacturing and Sustainment Technologies (iMAST) teamed with the Naval Surface Warfare Center - Carderock Division for Navy in-service experience and their expertise in functional and performance requirements of watertight doors, and with NGSB for their expertise in door installation and shipbuilder requirements.

PERIOD OF PERFORMANCE:

June 2004 to September 2008

PLATFORM:

CVN 78

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

iMAST

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STAKEHOLDER:

PMS 378

TOTAL MANTECH INVESTMENT:

$2,312,000

Computed Radiography Has Potential to Greatly Reduce Cycle Times

PERIOD OF PERFORMANCE:

November 2004 to
September 2008

PLATFORM:

CVN 78

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

CNST

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PMS 378

TOTAL MANTECH INVESTMENT:

$1,371,000

S2057 — Digital Radiography

Objective

Current film-based radiographic inspection processes are very cycle time intensive, requiring manual handling of materials throughout the entire process. The film-based inspection process uses expensive, non-reusable film and chemicals that contain materials (like silver) that are potentially hazardous to the environment and waste thousands of gallons of water every year. This Northrop Grumman Shipbuilding - Newport News (NGSB-NN)-led project used commercially available computed radiography (CR) equipment to extend current technology developed processes and standards that replaced the current film-based process in critical naval applications, including the FORD Class aircraft carrier and VIRGINIA Class submarine construction programs.

Payoff

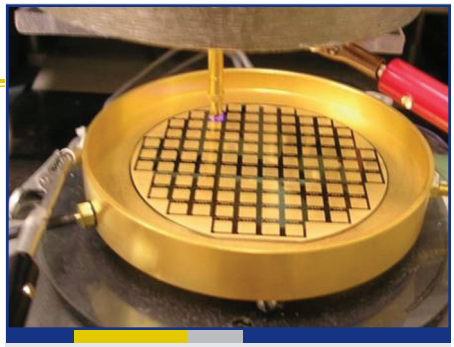
NGSB-NN estimates that this technology has the potential to improve cycle times ten-fold by eliminating film developing, manual transport of conventional radiographic materials, and manual storage and retrieval of film / records. Additionally, CR will substantially reduce consumption of radiographic expendables (films and development chemicals). A conservative estimate is that this technology will result in a 50% reduction in films and development materials, resulting in a cost savings of approximately $400K over five years.

Implementation

Technology transition has been supported throughout the project with several workshops focused on participants' acquisition of CR knowledge and participation in the development of new naval standards for personnel qualification, CR system qualifications, and the new CR inspection standards. The NAVSEA Technical Warrant Holder for Non-Destructive Testing has been involved throughout the process and recently visited NGSB for a demonstration of the 50 micron FUJI System and a review of the weld coupon data. In August 2008, data supporting transition and the final version of the draft Naval Standards were submitted to NAVSEA 05ME for approval. Computed radiography technology was employed for corrosion inspection of aged piping systems during a major surface ship availability in July 2008. Much of the knowledge and capability (including the CR equipment) used for this application was derived from this CNST Digital Radiography Project. Inspection methods were reviewed and approved by NAVSEA. Upon NAVSEA 05ME approval of the Naval Standards, NGSB will implement CR in the Welder's School for all weld coupons.

Size and Weight Reduction of Components in Power Conversion Circuit

S2099 — High-Power SiC PiN Diode Manufacturing



Objective

The Department of Defense is moving towards platforms and weapon systems which utilize electrical power in new ways. The concept of an "electric warship" depends on the ability to rapidly switch power to major loads to meet tactical needs. To meet these performance challenges new wide bandgap semiconductor materials and devices based on silicon carbide (SiC) are required to enable solid state power substations (SSPS) for future Navy ships. Compared to similarly sized devices fabricated from standard silicon, high-voltage power switches and diodes fabricated from SiC offer a reduction in on-state resistance of more than 100 times. Furthermore, SiC offers dramatically lower switching losses which allows the use of higher frequency AC power, thus enabling a reduction in the size and weight of passive components in the power conversion circuit. The objective of this project is to address the manufacturing issues which presently limit the yield of high-voltage SiC diodes needed for the switching modules of the SSPSs for future Navy ships.

Payoff

Traditional approaches for power distribution being considered for the next generation of carriers and destroyers employ 13.8 kV AC power that is stepped down to 450 V AC by using large (6 ton and 10m3) 2.7 MVA transformers. The advanced power electronic components of interest under this effort will enable the realization of a SSPS that converts the same total power level as the traditional approach with a reduction in size of 60% and reduction in weight of approximately 2.6 tons for a single 2.7 MVA transformer. Thus, the payoff for an aircraft carrier generating more than 100 MVA of power is a total reduction in weight and volume which exceeds 100 tons and 240m3.

Implementation

Cree, Inc, the subcontractor for this project and the leading provider of SiC materials and devices, is presently developing SiC power switching transistors and diodes targeted for 10kV, 110A power switching modules. The manufacturing technology developed in this effort is required to enable these switching modules to be produced for the SSPSs of future Navy ships such as CVN 78 and DDG 1000. The technology developed in this project is one component (i.e., the semiconductor device) in a joint DARPA / ONR effort, supporting the next level packaging, thermal management and ultimately the end unit, the SSPS.

PERIOD OF PERFORMANCE:

December 2005 to March 2009

PLATFORM:

CVN 78

AFFORDABILITY FOCUS AREA:

Electronics

CENTER OF EXCELLENCE:

EOC

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STAKEHOLDER:

PMS 378

TOTAL MANTECH INVESTMENT:

$3,106,000

Alloy 625 Forming Parameters Developed for Critical CVN 78 Components

PERIOD OF PERFORMANCE:

February 2007 to October 2009

PLATFORM:

CVN 78

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

NMC

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STAKEHOLDER:

PMS 378

TOTAL MANTECH INVESTMENT:

$2,035,308

S2102 — Alloy 625 Formability for Future Carriers

Objective

The objective of this project is to identify optimal forming practices for Alloy 625 in several critical CVN 78 components as well as to identify maximum forming limits.

Payoff

One benefit of this project is to demonstrate that it is possible to achieve very large cold deformations in the fabrication of the various components without impairing the mechanical / physical properties and corrosion resistance. This project could result in significant cost reduction because the fabrication of components could last the life of the ship without replacement.

Implementation

Fabrication of these components is planned early in the production cycle for CVN 78; therefore, the results of this project are being implemented immediately into the fabrication process. The specifications and procedures developed during this project will directly translate into Northrop Grumman Shipbuilding - Newport News (NGSB-NN) procurement specifications, drawing callouts, tooling design and process instructions.

Tandem Gas Metal Arc Welding Offers Significant Cost Reduction Opportunity

S2123 — Tandem GMAW for Ship Structures

Objective

The Navy Joining Center (NJC) is participating in an integrated project team along with PMS 378, PMS 450, Northrop Grumman Shipbuilding - Newport News (NGSB-NN), and Naval Surface Warfare Center - Carderock Division (NSWC-CD) to develop and implement high productivity Tandem GMAW for out-of-position mechanized butt welding of high-strength steel erection joints for ship structures. The NJC objective is to develop and demonstrate welding procedures necessary to support the required productivity improvements. The technology will initially be implemented at NGSB-NN for CVN 78 horizontal butt joints and overhead joints for the flight deck and later for horizontal welding of VCS modules. The welding technologies developed during this project are expected to have wider applications to other Navy ships, including DDG 1000 and T-AKE ships for the Military Sealift Command.

Payoff

Tandem GMAW has the potential to increase deposition rates by a factor of 2 or more over conventional mechanized GMAW. Preliminary estimates on the amount of out-of-position welding are approximately1,400 feet for VCS and 5,800 feet for CVN 78. This represents over 30,000 labor hours annually. Two- to three-fold improvements in deposition rate offer the potential for significant labor hour reductions. Additional cost reductions are expected through an increase in weld quality. The T-GMAW process has been shown to reduce weld root defects and improve weld bead profile with proper optimization. A cost avoidance of approximately $750K per hull for CVN is anticipated.

Implementation

The Integrated Project Team includes PEO (Carriers), PEO (Subs), and NGSB-NN to help ensure implementation of the T-GMAW on both SSN 781 and CVN 78. In Phase Three of the project, a shipyard system will be acquired by NGSB-NN. Procedures will then be refined, qualified, demonstrated, and validated. NGSB-NN has stated their intent to implement the developed welding procedures pending the results of the project. Initial implementations of these technologies are expected to occur in calendar year 2009.

PERIOD OF PERFORMANCE:

April 2006 to September 2009

PLATFORM:

CVN 78

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

NJC

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STAKEHOLDER:

PMS 378

TOTAL MANTECH INVESTMENT:

$527,000

LASCOR Reduces Weight and Cost for CVN 78 and DDG 1000 Applications

PERIOD OF PERFORMANCE:

February 2007 to
September 2009

PLATFORM:

CVN 78

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

NMC

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STAKEHOLDER:

PMS 378

TOTAL MANTECH INVESTMENT:

$2,999,997

S2170 — LASCOR Panel Evaluation and Implementation Phase II

Objective

The Navy is seeking solutions to reduce weight and lower the center of gravity for surface ships to improve their performance at a reasonable cost. LASer-welded corrugated-CORe (LASCOR) metallic sandwich panels are stiff, lightweight steel structures that offer the Navy corrosion resistance, reduced weight, and less distortion. The objective of this Navy Metalworking Center (NMC) project is to complete tasks needed to support the transition of LASCOR to future Navy applications. This is being accomplished by optimizing the LASCOR design for materials, manufacturability, joining, structural and protection performance, and cost.

Payoff

The use of LASCOR technology offers a lightweight, stiff ,and modular structural steel system to reduce weight and improve performance. It is expected that LASCOR structures will result in a weight reduction of between 15% and 30% over conventionally fabricated structures.

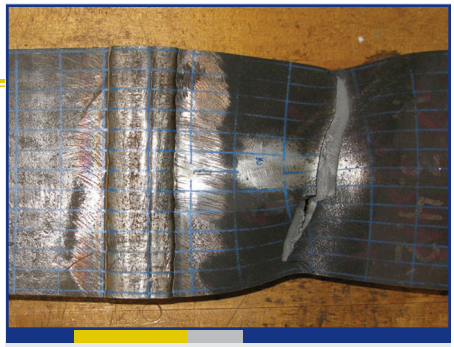
Implementation

LASCOR is being evaluated for future applications on CVN 78 in parallel with completion of the structural and material testing required for NAVSEA endorsement of the technology. Provided that LASCOR designs offer the shipyard improved performance or cost reduction, LASCOR may be incorporated into baseline designs for future construction. Also, LASCOR is being considered for other ship platform use, and this project will help to streamline future shipyard implementation efforts.

Based on the work conducted under this project, a competitive bid initiated by General Dynamics Bath Iron Works (BIW) resulted in a multi-million dollar contract to develop, test, and manufacture ship sets of Deck Edge Safety Berms and Personnel Safety Barrier Panels for DDG 1000 using hybrid laser-welded metallic sandwich panel technology, with approximately 84 panels per hull. This technology was selected as the low cost, technically compliant solution to meet weight, structural, heat, and other requirements while offering corrosion resistance, reduced weight, and less distortion. Under a joint lead ship program, the first two ships of the DDG 1000 class are being built by BIW and by Northrop Grumman Shipbuilding - Gulf Coast. A separate project is pending endorsement to develop, manufacture, test and subsequently qualify LASCOR.

HSLA-115 in CVN 78 Baseline Design Results in Reduced Weight Per Hull

S2171 — HSLA-115 Evaluation and Implementation Phase II



Objective

The Navy is seeking solutions to reduce weight and lower the center of gravity for CVN 78 to improve performance at a reasonable cost. The goal of this Navy Metalworking Center (NMC) project is to increase the performance and strength of HSLA-100 (high-strength, low alloy) steel through heat treatment to enable use of this new HSLA-115 (115 ksi yield strength) steel at reduced thickness, and thus, reduced weight, while meeting all performance requirements. In addition, the objective is to evaluate HSLA-115 for a large-scale production plate application and determine HSLA-115's performance, manufacturability, welding and shipyard practice optimization, and vendor qualification.

Payoff

Implementation of HSLA-115 for the target application on CVN 78 may result in 100 to 200 long tons of topside weight reduction per hull. A cost-neutral impact to acquisition cost for HSLA-115 implementation is estimated. The improved minimum yield strength level of the HSLA-115 also offers enhanced factor of safety in areas where the application thickness may not be reduced, but where the design performance and strength are enhanced without a weight penalty. Additional applications may be considered in future designs.

Implementation

The Future Aircraft Carriers Program Office has approved the use of HSLA-115 in the CVN 78 baseline design, and HSLA-115 has been incorporated into the ship specifications and the fabrication document. These revisions allow the use of HSLA-115 for CVN 78, and offer a cost-neutral implementation. Material Selection Information (MSI) certification testing has been completed successfully to support CVN 78 construction material procurement dates. NAVSEA has approved the MSI documentation, which allows Northrop Grumman Shipbuilding - Newport News to incorporate HSLA-115 into the baseline design and implement it into the CVN 78 construction production schedule as planned.

PERIOD OF PERFORMANCE:

February 2007 to February 2010

PLATFORM:

CVN 78

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

NMC

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STAKEHOLDER:

PMS 378

TOTAL MANTECH INVESTMENT:

$ 3,507,405

Automation Optimized to Improve Overall LASS Yield and Reduce Final Cost

PERIOD OF PERFORMANCE:

January 2007 to April 2009

PLATFORM:

CVN 78

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Electronics

CENTER OF EXCELLENCE:

EMPF

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STAKEHOLDER:

PMS 378

TOTAL MANTECH INVESTMENT:

$5,307,000

S2173 — Manufacturing of Light Activated Semiconductor Switches Phase III

Objective

Advanced weapons and defense systems for meeting mission requirements for lethality and survivability require the use of high power, very fast switching (high dI/dt) switches that are cost-effective to manufacture. Gas and vacuum switches have the potential to meet the performance requirements, but their reliability over repeated operation and cost of ownership preclude their use. The logical alternative to meet these demanding requirements is the use of solid state switches, since their reliability and lifetime are much greater than gas or vacuum switches. However, existing solid state switches do not simultaneously meet the high current and high dI/dt requirements. The Light Activated Semiconductor Switches (LASS) program has developed a manufacturing supplier of solid state switches that meet DOD requirements for a high current, high dI/dt switch. The objective of this project is to establish a manufacturing line to provide LASS switches for military and commercial applications. The Technical Readiness Levels (TRLs) of the LASS and its components have been assessed at regular intervals during the program. The LASS device is currently being tested and is expected to pass TRL5. This project has addressed the following areas: (1) development of lower cost silicon doping processes to improve the lifetime and uniformity of high power silicon devices; (2) manufacturing process development for high voltage devices; (3) packaging of high power, light activated thyristors; (4) development of a fiber optic coupled laser light source; (5) integration and testing of the laser light source; and (6) integration and testing of the LASS thyristor package and integrated laser light source.

Payoff

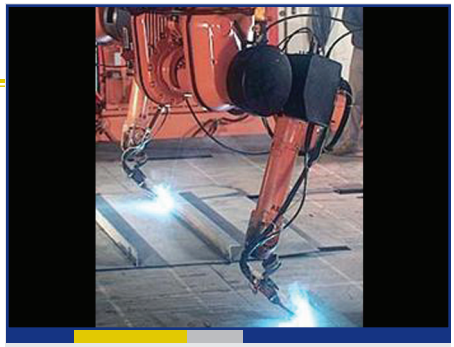
The demonstrated benefits of this project are that a manual manufacturing operation was converted into an automated manufacturing facility that is capable of producing a significantly higher volume of LASS switches with a much improved process yield. Costs have been significantly lower and a savings of $20K per switch is expected with an initial production of 300 switches planned. The total cost reduction is $6M.

Implementation

Phase 3 of this project has continued to optimize the processing, packaging, and manufacturing automation to improve overall LASS yield and reduce the final cost. The ManTech project has developed a manufacturing line at OptiSwitch Technology Corporation (OTC) that is capable of providing a sufficient number of LASS devices for DOD needs. Environmental testing has begun on the major components of the Light Activated Semiconductor Switch to determine how well they perform in a relevant environment. Sufficient data will be acquired to demonstrate a LASS device in a relevant environment meeting all unclassified requirements. Implementation will be accomplished by qualifying the Light Activated Semiconductor Switch in the test bed of a DOD mission critical application. Technology Readiness Level (TRL) 5/6 qualification is planned to be completed by the end of Q2 FY09. The project is currently targeting implementation on later flights of the CVN 78 Class.

Optimized Welding for Thin Panels Expected to Result in Cost Reduction of $2.4M Per Hull for CVN 78

S2198 — Control of Thin Panel Distortion



Objective

Operational requirements for the CVN 78 aircraft carrier require reducing the weight of ship structures. Therefore, CVN 78 will be constructed of much lighter weight sponsons, decks, bulkheads, and other structures than those for previous aircraft carriers. It is well documented that distortion due to thermal cutting and welding becomes a significant manufacturing problem as the thickness of plates and panels is reduced. Thin steel panels are more likely to deform, and production of these panels is more difficult since the structures lack rigidity until integrated into a unit. Distortion of thin panels makes it more difficult to fit and weld subsequent assemblies and units, as well as to meet fairness and straightness requirements. Distortion repair costs include rework of unit fit-up, flame straightening, and rewelding. The result is increased ship construction costs and longer schedules. Navy acquisition costs can be significantly reduced by implementing new production processes that minimize bucking distortion of lightweight structures. The objective of this project is to apply new technologies and best practices to reduce distortion for CVN 78 thin structures.

Payoff

Implementation of the recommendations of this project will reduce production hours required to achieve dimensional control of structures during the construction of CVN 78. Without improved control of distortion, the labor hours that would be needed to correct distorted structures on CVN 78 are projected to increase by 30% compared to those expended during the construction of CVN 77. Approximately half of the cost is the labor required to correct distortion during the fitting of subassemblies and units. An equal amount of labor is required for flame straightening to meet fairness requirements of final assembled units. The goal for this project is to reduce these labor-hours by 20% for CVN 78, at a cost benefit estimated to be $2,434K.

Implementation

The distortion control technology for thin panel fabrications that result from this ManTech project will be implemented by Northrop Grumman Shipbuilding - Newport News (NGSB-NN) on CVN 78. Implementation will begin with the fabrication of thin panels for the second deck thin plate structure, scheduled to begin in the first quarter of 2010.

PERIOD OF PERFORMANCE:

April 2008 to April 2009

PLATFORM:

CVN 78

AFFORDABILITY FOCUS AREA:

Distortion Reduction

CENTER OF EXCELLENCE:

NJC

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STAKEHOLDER:

PMS 378

TOTAL MANTECH INVESTMENT:

$361,000

High Power, High Temperature Packages to Reduce Weight and Size of Naval Power Conversion Equipment

A2213 — High Voltage Encapsulation for High Power SiC Device Packaging

PERIOD OF PERFORMANCE:

July 2007 to January 2009

PLATFORM:

CVN 78

AFFORDABILITY FOCUS AREA:

Electronics

CENTER OF EXCELLENCE:

EMPF

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STAKEHOLDER:

PMS 378

TOTAL MANTECH INVESTMENT:

$1,071,118

Objective

The Navy's next generation surface combatants will require a fundamental change in how electric power is converted, distributed, and managed to fully use the electric power available. Current ideas for generating pulsed power require the use of heavy, bulky systems placed in areas not optimal for carrier design. One method to reduce the weight and size of the current iron and copper transformers used in legacy power distribution systems is to use a solid state transformer to combine power electronics with a transformer that is reduced in size due to the increased operating frequency of the power electronics.

The new Wide Band Gap (WBG) semiconductor materials, principally SiC, operate at higher temperatures and require less cooling. The higher blocking voltages and lower switching loss at high frequency of SiC devices allow for the use of smaller transformers and inductors. Power conversion equipment developed using SiC technology is projected to significantly reduce the workload and maintenance requirements for current and future carriers and is considered a critical step in achieving CVN 78 compliance with Key Performance Parameters for weight reduction and ship stability. Improved thermal management of semiconductors and passive components through ungraded packaging would allow more current to be handled by a given device and lead to improved power destiny designs. The development of a 2.7 MVA Solid State Power Substation (SSPS) has been identified as a first demonstration vehicle. The objective of this project is to develop and demonstrate the reliability of a high temperature packaging methodology that is applicable to current power devices / modules as well as readily adaptable to future power device technology.

Payoff

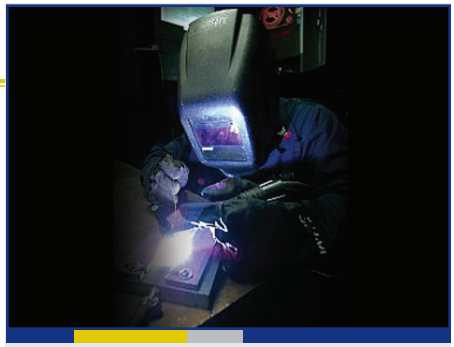
This effort is developing and demonstrating the reliability of a manufacturing technology for high temperature packaging that will advance the overall power components industry. These materials and processes will be applicable to the present silicon-based power devices / modules, as well as future SiC-based modules. The end result will lead to more versatile power electronics packaging materials for operation above 10kV and 150-200°C. This packaging effort will enable the Navy to realize the high temperature operation potential of WBG semiconductor materials with packaging materials technology that meets SSPS operational specifications not currently offered by the power electronics industry. The power electronics components produced using this new manufacturing technology will enable the design and development of power distribution systems that are 60% smaller and weigh 2.68 tons less than current systems.

Implementation

The transition strategy for this project is governed by the "Memorandum of Agreement" between DARPA, ONR, and PEO Carriers regarding the use of Wide Band Gap Semiconductors for a ship's high power distribution system. At the conclusion of the ManTech project, the manufacturing technology will be implemented at Powerex Inc. for use in the manufacturing of power electronics modules specified by the SSPS program, as well as components required for other DOD programs.

Web-Based Welding Procedure to Greatly Reduce Costs Associated with Rejected Vendor Submissions

S2228 — Web-Based Welding Procedure System



Objective

The Navy's requirements for qualification of welding procedures and welder performance can make it difficult for inexperienced vendors to develop the required documentation. In fact, Northrop Grumman Shipbuilding-Newport News (NGSB-NN) has reported that a large percentage of vendor-submitted weld procedures are rejected, with many vendors resubmitting procedures multiple times before gaining approval. While commercially available software exists to help develop procedures for American Welding Society, American Society of Mechanical Engineers, and other commercial specifications, no equivalent tool exists for the Navy specifications. The Navy Metalworking Center (NMC) is continuing the development of a Web-based welding procedure system intended to reduce the rejection rate of vendors' submitted procedures, along with the resulting additional costs. This project, which includes contributions from Weld QC, NGSB-NN, General Dynamics Electric Boat (GDEB), the Future Aircraft Carriers Program Office and Naval Surface Warfare Center - Carderock Division, will leverage a prototype system that was developed and demonstrated under a Small Business Innovative Research (SBIR) project sponsored by ONR and will extend its capabilities and cost savings.

Payoff

As a result of the reduced rejection rate of vendors' submitted welding procedures, cost savings will be generated from reduced production delays, increased competition among vendors, better vendor retention and welding engineers' increased availability to focus on other process improvements. The goal is to reduce the rejection rate from above 90% to less than 20%. Estimated annual savings is approximately $2.58M from vendor and shipyard labor savings alone.

Implementation

Implementation is expected to begin with approximately 20 vendors in the 2nd quarter FY09 on the hull and piping and machinery systems for CVN 78 and be used by all CVN 78 vendors by the end of FY09. The software system may be applicable to most non-nuclear-related welding on CVN 79, VIRGINIA Class Submarine (VCS), DDG 1000, Littoral Combat Ship (LCS), Amphibious Transport Dock (LPD), and Auxiliary Dry Cargo Carrier (T-AKE).

PERIOD OF PERFORMANCE:

December 2007 to May 2009

PLATFORM:

CVN 78

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

NMC

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STAKEHOLDER:

PMS 378

TOTAL MANTECH INVESTMENT:

$827,491

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DDG 1000 Projects
Table of Contents

NAVY MANTECH
Manufacturing Technology Program

DDG 1000 Projects

Hybrid Laser Welding Reduces Cost and Distortion

PERIOD OF PERFORMANCE:

January 2005 to
September 2009

PLATFORM:

DDG 1000

AFFORDABILITY FOCUS AREA:

Distortion Reduction

CENTER OF EXCELLENCE:

iMAST

POINT OF CONTACT:

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STAKEHOLDER:

PMS 500

TOTAL MANTECH INVESTMENT:

$2,198,000

S2073 — Hybrid Laser Beam Welding

Objective

Hybrid laser arc welding is being developed as a means to increase affordability in ship construction. Under this project, hybrid welding processes will be developed, tested, and demonstrated within the shipyard for welding thin steel panel structures. The target platform is DDG 1000; however, the successful process could be implemented to support the construction of other vessels, including LPD 17, CVN 78, LHA 6, and CG(X). A Qualification Roadmap will be developed, outlining the required welding qualification testing and evaluation that must be performed prior to welding on ship structures. Transition occurs when a shipyard suitable hybrid process has been developed, demonstrated and proven to be technically and economically feasible.

Payoff

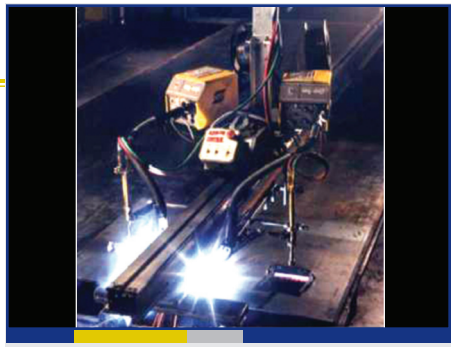
The implementation of a hybrid welding process for distortion control is an immediate need for production of thin steel Navy structures. This technology will impact applications aboard DDG 1000, as well as current and future Navy designs such as LPD 17, LHA 6, CVN 78, and CG(X). It has been conservatively estimated that for implementation of a hybrid welding process for panel butt welds, that the potential savings could be between $0.8M and $2.9M per DDG 1000.

Implementation

There are two major transition events for the program: (1) execution of the Qualification Roadmap and (2) successful demonstration and adoption of the hybrid welding process within the shipyard. Initial qualification testing will provide supporting data that the hybrid welding process is sufficiently under control to produce welds in thin steel panel structures that meet weld performance and fabrication criteria (according to NAVSEA S9074-AW-GIB-010/248 and MIL-STD-1689, and/or Part 8 of the ABS Naval Vessel Rules). Demonstration of the hybrid process for welding of a typical ship structure within the shipyard will enable the confirmation of critical program metrics, that the process exhibits at least 50% less distortion, and is economically justifiable as compared to the conventional welding process. Attaining these goals will provide sufficient evidence to the implementer (shipyard), stakeholder (PMS 500) and technical warrant holder (NAVSEA 05P24) that the hybrid welding process for panel line applications is technically and economically feasible, thereby transitioning the technology to the implementer. Implementation is achieved when NAVSEA approves, PMS 500 includes in the design, and the shipbuilder acquires the equipment necessary to hybrid weld thin panel structures for DDG 1000. Implementation for selected applications at a shipyard is targeted late FY09.

Thermal Tensioning Realizes Significant Cost Avoidance by Reducing Rework

S2084 — Thermal Tensioning of Thin Steel Ship Panel Structures



Objective

Shipboard applications for lightweight structures in naval vessels have increased over recent years. Buckling distortion of complex lightweight panels has historically had significant impact on manufacturing cost and production throughput, limiting the ability of shipbuilders to produce innovative ship designs. This Northrop Grumman Shipbuilding- Gulf Coast (NGSB-GC)-led effort was aimed at the efforts to facilitate the implementation of a distortion mitigation program specific to the welding of stiffened thin steel panel ship structures. The successful completion of this project validated the opportunity to realize significant savings by reducing rework NGSB-GC developed transient thermal tensioning technology to reduce the amount of flame straightening required for thin steel structures and improve deck plate flatness. This technology is applicable to the following platforms: LPD 17, DDG 51, and DDG 1000.

Payoff

This project is anticipated to reduce labor associated with flame straightening of thin steel structures and improve deck plate flatness resulting in reduced maintenance and life-cycle costs. Anticipated cost reductions fall into two categories: acquisition cost avoidance and life-cycle cost avoidance. With acquisition cost avoidance, preliminary calculations estimated the cost reduction due to reduced distortion at $11M per LPD vessel. Life-cycle cost avoidance is estimated through flatter panels that result in less standing water and reduced maintenance. Original estimates for DDG 1000 indicate a ship maintenance savings of over $60M and reduced corrosion control costs of over $5M.

Implementation

NGSB-GC developed and refined the numerical modeling process for transient thermal tensioning. The system was designed and fabricated, with prototype equipment installed and tested on the NGSB-GC panel line. Validation tests were performed prior to shipyard production trials. The system was turned over to production, and the results were significant. The project team conducted a workshop to transfer this technology to the shipbuilding industry. The NGSB-GC team is developing a Phase III effort with the intention to design, fabricate, and install a stationary unit in the new NGSB-GC panel line facility in late 2009.

PERIOD OF PERFORMANCE:

June 2005 to April 2008

PLATFORM:

DDG 1000

AFFORDABILITY FOCUS AREA:

Distortion Reduction

CENTER OF EXCELLENCE:

CNST

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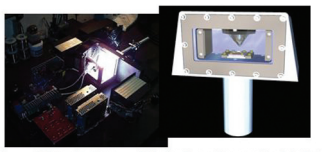
STAKEHOLDER:

PMS 500

TOTAL MANTECH INVESTMENT:

$1,200,000

New Fiber Technology Reduces Illuminators and Cost for Ships' Lighting



Illuminator Waterline Security Light

PERIOD OF PERFORMANCE:

February 2007 to September 2008

PLATFORM:

DDG 1000

AFFORDABILITY FOCUS AREA:

Electronics

CENTER OF EXCELLENCE:

EOC

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STAKEHOLDER:

PMS 500

TOTAL MANTECH INVESTMENT:

$759,000

S2119 — Remote Source Lighting Fiber Performance Improvement

Objective

The objective of this project was to develop the manufacturing technology to significantly improve the efficiency of Remote Source Lighting (RSL) systems at reduced cost by increasing fiber Numerical Aperture (NA), so that more light can be coupled into the RSL fiber over larger collection angles, resulting in more lumen output, more luminaries per illuminator, and less illuminators per ship. It is anticipated that increasing NA from 0.33 to approximately 0.48 will provide a 50% improvement in light collected by the fiber.

Payoff

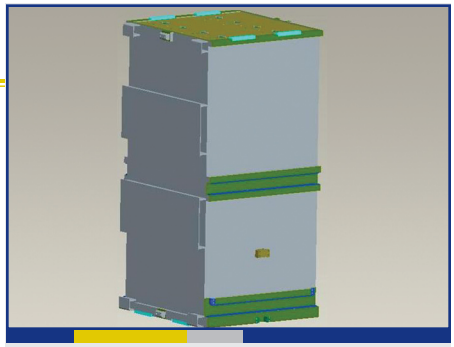
This project leverages recent manufacturing improvements in specialized hard cladding designs of silica optical fiber for improved efficiency, at reduced cost, for next generation RSL for deployment on DDG 1000. The improved optical fiber technology drawing technique and cabling process have provided compatibility with the existing cable, connection hardware, coupling hardware, termination methods, and coupling optics. This has resulted in more light being coupled into the RSL fiber over larger collection angles, resulting in more lumen output, more luminaries per illuminator, and less illuminators per ship. The new fiber technology is planned to reduce the number of illuminators from 75 to 50 for the DDG 1000, with corresponding cost savings of $250K per ship.

Implementation

The Northrop Grumman Shipbuilding (NGSB) team, comprised of Omni Technologies Inc (OTI), RSL Fiber Systems LLC (RSLFS), Polymicro Technologies, and Draka, were contributors to this project. This was the same team which was responsible for the earlier RSL development that was implemented and is currently in use on the LPD 17. Successful transition and implementation of the technology developed in this effort will be achieved when the NGSB system integrator incorporates the new RSL fiber / cable system into the DDG 1000 design and manufacturing plan. To assure this, testing and measurements of the optical fibers, the single fiber termination performance, and the complete new cable with the new cladding has demonstrated the required performance characteristics. The testing demonstrated manufacturability of optical fibers with enhanced hard cladding, achieving the targeted improvement in Numerical Aperture and increased light collection. The other criteria for successful implementation which were met include maintaining acceptable fiber cladding thermal conditions, acceptable fiber yields and fiber optic cable yields, and consistent repeatability of fiber / cable processes to ensure consistent improved light collection increase. The new RSL technology is now in the baseline design for DDG 1000 and is being implemented at Northrop Grumman Shipbuilding in Pascagoula, MS for use on DDG 1000 and DDG 1001.

Manufacturing and Material Enhancements Offer Opportunities to Reduce AGS Cost and Weight

S2132 — Low Cost Pallet Systems Phase I



Objective

The DDG 1000 will be equipped with two Advanced Gun Systems (AGS). The current design of the automated AGS pallet has a projected cost significantly higher than originally anticipated, adversely affecting the overall AGS production budget. Due to the rapid development and deployment cycle, Naval Surface Warfare Center-Dahlgren Division (NSWC-DD) determined it beneficial for Navy Metalworking Center (NMC) to conduct, in parallel with the ongoing development by the systems designer, a separate evaluation of the manufacturing materials and methods that the pallet system will require. The objective of this project is to reduce the cost and weight of the Advanced Gun System (AGS) pallets by investigating various production, manufacturing, processing and material enhancements. The manufacturing approach will be reviewed and opportunities for reduced cycle time, enhanced material selections and alternative manufacturing approaches — such as friction stir welding or near-net-shape casting — will be identified. Proposed production methods will focus on decreasing the time and cost to manufacture the pallets, while maintaining the tight tolerances needed for the pallets to function properly.

Payoff

NMC has developed numerous manufacturing enhancements to reduce manufacturing costs, including incorporating friction-stir welding, which also decreases weight and pallet distortion; reducing part count and simplifying the aft projectile and propellant charge latching mechanisms; and modifying the shipping covers. These improvements could result in a per-pallet cost reduction of greater than $49K from the baseline per-pallet estimated cost of $233K – a savings of approximately 21%. With 75 pallets per DDG 1000, a total of $6.9M could be saved for the first two DDG 1000 hulls, not counting the additional 150 pallets anticipated for spares and replenishment.

Implementation

NMC is executing this project with cooperation and assistance from personnel at PEO (IWS) 3C, NSWC-DD, NSWC PHD(L), and BAE Systems (Armament Systems Division). The current manufacturing schedule for test, qualification and LRIP pallets is under revision, requiring a series of pallets in the 2010-2012 timeframe. NMC plans for Phase II of Low Cost Pallet Systems to begin in December 2008. Anticipated implementation activities include prototype fabrication and test of various components studied and developed during Phase I, leading to transition at BAE Systems production facility in Louisville, Kentucky, for incorporation into the final AGS data package in 2009 prior to the 2010-2012 test activities.

PERIOD OF PERFORMANCE:

May 2007 to December 2008

PLATFORM:

DDG 1000

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

NMC

POINT OF CONTACT:

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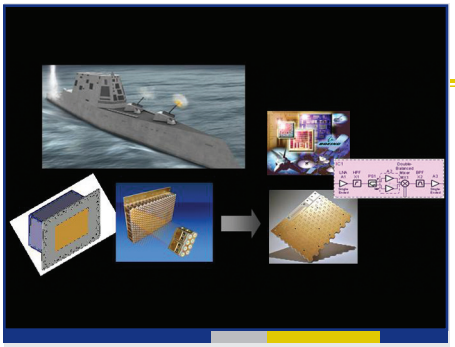
STAKEHOLDER:

PMS 500
PEO (IWS)

TOTAL MANTECH INVESTMENT:

$1,095,000

System-On-Chip Technology Produces Low Cost, Lightweight T/R Modules for Phased Array



PERIOD OF PERFORMANCE:

July 2006 to May 2010

PLATFORM:

DDG 1000

AFFORDABILITY FOCUS AREA:

Electronics

CENTER OF EXCELLENCE:

EMPF

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STAKEHOLDER:

PMS 500

TOTAL MANTECH INVESTMENT:

$1,874,000

A2147 — SiGe-Based System-On-Chip Low Cost / Weight Phased Array Antennas Phase B

Objective

This project will demonstrate three phased array antennas—receive, transmit, and combined transmit / receive (T/R)—for development. Boeing is providing the multi-beam Ku-band Communications Data Link (CDL) Phased Array Antenna (PAA) system to DDG 1000. These antennas will be designed for operation in the Ku-band which is suitable in both surface and airborne applications. For several years, Boeing has been doing research into new technologies that promise a breakthrough in phased array antenna cost, with significant improvements in size and weight. This work has helped prove feasibility of many necessary technology building blocks, but the building blocks have not yet been integrated into a comprehensive demonstration. The primary new technologies involve the use of flip-chip and chip-on-board interconnect technologies to replace current wire-bonding and multi-chip-module technologies and the development of a highly integrated system-on-chip (SOC) using silicon-germanium (SiGe) process technology to replace current gallium-arsenide (GaAs)-based Microwave Monolithic Inte-grated Circuit (MMIC) chipsets.

Payoff

The main benefit of this project is to provide smaller, lighter T/R modules using a system-on-chip technology that can also reduce cost due to integration savings. A cost avoidance of 50-65% and a weight reduction of 15-25% compared to current phased array antenna technology can be achieved using Boeing's chip-on-board approach based on the use of GaAs technology. The use of SiGe technology can further reduce semiconductor chip-set costs by up to 90%. In addition, the chip-on-board technology currently in development at Boeing is limited to ~15-20 GHz due to the lattice spacing requirements and the size of GaAs chips necessary to perform the module functions. SiGe has the potential to reduce the chipset footprint, thus extending the practical frequency range for this architecture to 40 GHz or beyond. Cost avoidance starts at $793K per ship set for the DDG 1000. This reduction is obtainable by reducing the chipset die element parts such as RF distribution, array system components, element assembly, and test labor.

Implementation

In Phase 2 of this project, Production Readiness Phase, the technologies developed and demonstrated in Phase 1 will be tooled up and made ready for DDG 1000 production insertion by the Boeing DDG 1000 program. The first SiGe SOC-based CDL PAAs are planned for insertion on DDG 1002 (Ship 3).

The technologies developed as a result of this work will have potentially wide applicability to Navy programs. Based on the current generation of technology, the following applications can be addressed: multi-chip module (MCM), brick-style antenna packaging, and MMIC chipsets. These basic proven technologies can be adapted to meet a diverse range of antenna requirements. The basic packaging architecture can also be adapted, depending on number of elements, number of beams, radio frequency band, and many other application-specific requirements. The underlying package design and manufacturing approach as well as the underlying SiGe technology design and fabrication methods will be proven and common between applications.

Affordable Stiffener Manufacturing Methods to Result in Significant Cost Savings for DDG 1000

S2149 — Cost-Effective, Integrated Stiffener Manufacturing for DDG 1000 Integrated Deckhouse and Hangar (IDHD)

Objective

The DDG 1000 requires a helicopter hangar with extended, unsupported spans that result in demanding stiffness requirements for the materials used in the hangar. The hangar must also support two guns and associated equipment on the aft corners of the structure. A complex cross-section, carbon fiber/vinyl ester composite design was shown to meet the design requirements of the DDG 1000 hangar; however, these materials have only recently been considered for Navy shipbuilding applications. The size, laminate complexity, and thickness of the beams, and the fact that these beams intersect complex composite-to-composite and composite-to-steel joints, present manufacturing challenges not dealt with in the DDG 1000 program or previous composite shipbuilding programs. The objective of this project is to develop and demonstrate methods for manufacturing large thick cross-sectioned (>1.5") composite stiffeners and stiffener joints. VARTM approaches for constructing the stiffeners and joints will be developed and analyzed using Liquid Injection Molding Simulation (LIMS) and Polyworx software tools for infusion set-up optimization. Test articles fabricated are evaluated using non-destructive inspection and destructive testing to qualify results. The final portion of the project produces demonstration articles of both individual stiffeners and a representative full-scale article which incorporates both stiffener and associated joints.

Payoff

The project will result in a cost-effective manufacturing approach for the DDG 1000 composite helo hangar stiffeners. The principal benefit is the development of a predictable and repeatable process that reduces the defect rate associated with large thick cross-sectioned composite parts. The use of composites on the DDG 1000 and future surface combatants will ensure mission capability, increased performance resulting from lighter weight, and a reduction in life-cycle costs. Therefore, cost-effective composite manufacturing techniques represent a significant benefit to the Navy. The resultant beam configuration and chosen production method performed during the project l enables Northrop Grumman Shipbuilding (NGSB) to significantly reduce rework and the associated schedule impacts that could occur during production. A total cost avoidance of approximately 30% of the helo hangar stiffener fabrication and repair cost is estimated as a result of this effort. NGSB estimates that at least one complete box beam would be scrapped during the initial production processes of trying to manufacture these parts without the lessons learned from this project.

Implementation

Transition is expected to occur by February 2009 after the test data has been received and evaluated and the manufacturing processes and approach developed during the project are transitioned into work packages that will be used by NGSB to fabricate hangar box beams for DDG 1000. Project exit criteria include the determination of a hangar box beam fabrication approach, the efficient production of a representative full-scale article, and the successful non-destructive inspection of that article. To ensure implementation, NGSB must select the most efficient and robust manufacturing process, build the representative box beam test article configuration, and that article must pass ultrasonic inspection criteria for the DDG 1000 program. Navy Technical Authorities are integral to the success of this project and approve any and all article designs, test plans, and test reports produced as part of this project.

PERIOD OF PERFORMANCE:

July 2007 to February 2009

PLATFORM:

DDG 1000

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Composites

CENTER OF EXCELLENCE:

CMTC

POINT OF CONTACT:

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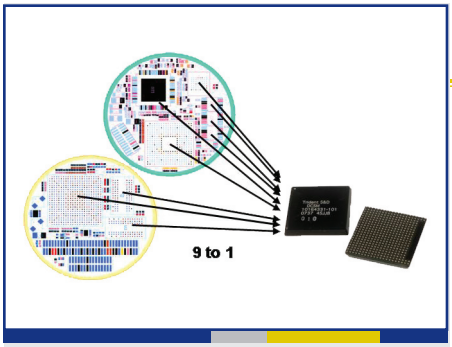
STAKEHOLDER:

PMS 500

TOTAL MANTECH INVESTMENT:

$1,535,647

Packaging Methodology Assesses Survivability and Improves Design of Electronics for Guidance Units



PERIOD OF PERFORMANCE:

September 2006 to
January 2009

PLATFORM:

DDG 1000

AFFORDABILITY FOCUS AREA:

Electronics

CENTER OF EXCELLENCE:

EMPF

POINT OF CONTACT:

Mr. Michael D. Frederickson
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STAKEHOLDER:

PMS 500

TOTAL MANTECH INVESTMENT:

$2,875,000

S2153 — High-g Packaging and Miniaturization of Electronics for Deeply Integrated Inertial Guidance Units

Objective

Honeywell's BG1930G deeply integrated Inertial Navigation System – Global Positioning System with Anti-Jam capability (INS-GPS/AJ) product has been baselined as the primary production navigation, flight control, and mission computer for Lockheed Martin's Long Range Land Attack Projectile (LRLAP) utilized in conjunction with the Navy's Advanced Gun System (AGS) for the DDG 1000 destroyer. This project will study the packaging of the BG1930G or similar product to assess its survivability to different gun launch environments and suggest improvements to the design. Another aspect of this project is the application of multi-chip module (MCM) technology to the discrete semiconductor approach used in the BG1930G, hereafter referred to System-On-a-Chip (SOC). The SOC approach is to combine the mission processor, inertial sensor assembly interface, digital anti-jam functions, user serial interface, and corresponding electronics functions onto a single substrate. Development and incorporation of SOC technology will effectively eliminate an entire printed wiring board from the product baseline.

Payoff

In the past, projectiles and components have been designed to a specification of "survive x-thousand G's", which has resulted in program extensions and overruns, and advances in modeling and simulation have proven this method of specification insufficient. An improved method of specifying design criteria is to specify a representative load curve (with margin) that includes the dynamics of the system. This project will apply this design methodology to the simulation of components for the Deeply Integrated Navigation and Guidance Unit (DIGNU) to determine survivability to gun launch and also make recommendations for design improvements. This project will also seek to determine the survivability of some MEMS sensors to the high shock of gun launch. If implemented, these recommendations would improve survivability. The application of MCM technology will reduce INS/GPS unit cost and will also reduce the INS/GPS size to fit more DOD weapon applications. The use of SOC technology will eliminate an entire printed wiring board from the product baseline and enable the achievement of aggressive Average Unit Production Pricing objectives, producibility, reliability, weight, and volume objectives mandated by LRLAP and other Joint Navy / USAF program applications.

Implementation

The effort detailed in this project is independent of an insertion target platform. The simulations to be performed, while dependent on the details of the individual IMU being modeled, can also form the basis for a methodology for improving the shock resistance of MEMS sensors and electronics modules for other precision guided munitions. At the conclusion of this ManTech effort, the memory system, processors and custom interface functions will have been successfully integrated into a single 27mm x 27 mm package, and both its functionality and suitability for gun-hard applications, such as the BG1930 and BG1940 family in INS-GPS/AJ products will have been confirmed. At this point, the Technology Readiness Level (TRL) of the SOC will be TRL 6—suitable for integration into a viable product.

Manufacturing Techniques for Very Large Radomes for DDG 1000 Could Reduce Cost by $1.6M Per Ship

S2159 — Low Cost Manufacturing Technology for Very Large Format Low Observable DDG 1000 Radomes Phase 1

Objective

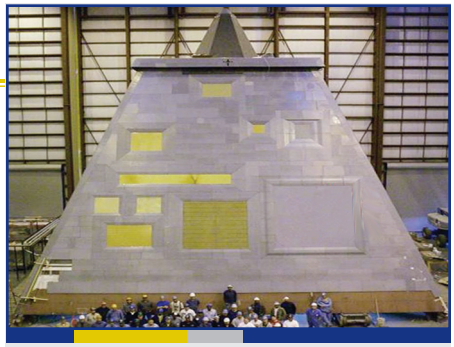
Future ship communications and radar systems require very large-scale, low observable (LO) radomes for mission success. Additionally, these radomes are supporting high frequency multi-band communication systems such as the Navy Multi-band terminal (NMT) and high power systems such as Volume Search Radar (VSR). Many of these systems involve multiple frequency bands within X, K, Ka, and Q. For example, EHF SATCOM requires a transmit band centered in K-band and a receive band in Q-band. Consequently, future ship radomes require large-scale Frequency Selective Surface (FSS) structures and laminate materials with tolerances held to values that are state-of-the-art for current (sizes less than 50 square feet) production radomes. The size of DDG 1000 proposed installations can reach 100-200 square feet. The FSS installations require seams, grounding, embedded treatments, anti-ice grids, and accurate FSS etch tolerances. To achieve the desired radome radio frequency (RF) performance levels, laminate wrinkling must be minimized, fiber volume fraction must be accurately controlled, and laminate thickness must be maintained within thousandths of an inch over the entire radome surface area. The objective of this project is to develop and demonstrate a low cost manufacturing method that integrates tailorable ply kits and optimized debulk cycles with in-process non-destructive inspection (both geometric and ultrasonic) and robust repair protocols to ensure very high yield DDG 1000 deckhouse EHF and X/Ka-band radomes.

Payoff

The cost of these radomes can exceed $1M each, and the radomes have become a significant portion of the DDG 1000 communications and radar system cost. In order to reduce radome acquisition costs, production radome fabrication yields must be pushed to nearly 100%. Without an innovative manufacturing approach, communication systems for future ships systems will remain expensive. Successful execution of this plan will help improve quality control for the fabrication of the Very Large, Multi-band EHF and X/Ka Radomes for DDG 1000. The proposed manufacturing techniques will improve yields by 20%, realizing a cost avoidance of $1.6M per ship. This results in a total savings for DDG 1000 and CG(X) of $21M. These savings are based on the build rates of seven DDG 1000 and six CG(X) found in the document,"Report to Congress on Annual Long-Range Plan for Construction of Naval Vessels FY2007."

Implementation

Raytheon is currently funded to design, develop, and integrate the new generation of electronics systems for DDG 1000, and the Navy is committed to deployment of these technologies. The technologies developed as part of the ManTech project will be inserted into the DDG 1000 program in 2008-2009 and will have an immediate impact on the first qualification and production radomes to be delivered in 2010.



PERIOD OF PERFORMANCE:

June 2007 to October 2009

PLATFORM:

DDG 1000

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Composites

CENTER OF EXCELLENCE:

CMTC

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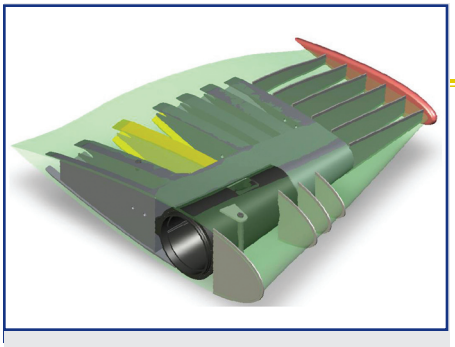
STAKEHOLDER:

PMS 500

TOTAL MANTECH INVESTMENT:

$1,034,000

Composite Twisted Rudder Improvements Result in Cost Savings of $1M Per Hull



PERIOD OF PERFORMANCE:

February 2007 to June 2009

PLATFORM:

DDG 1000

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Composites

CENTER OF EXCELLENCE:

CMTC

POINT OF CONTACT:

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STAKEHOLDER:

PMS 500

TOTAL MANTECH INVESTMENT:

$1,749,000

S2165 — Composite Twisted Rudder

Objective

Rudders on DDG 51 class destroyers experience severe cavitation-induced corrosion / erosion problems as a result of propeller wash. Naval Surface Warfare Center - Carderock Division (NSWC-CD) developed a "twisted" rudder geometry that better aligns the vertical rudder chord profile with the local hydrodynamic conditions. Steel twisted rudders were evaluated on the DDG 84 and indeed the onset of cavitation damage was delayed until higher ship speeds were reached. However, the complex rudder geometry is difficult to fabricate from steel. Additionally, coatings continued to deteriorate during the sea trials of the twisted rudder.

The DDG 1000 class baseline design calls for a more complex rudder geometry to further improve hydrodynamic performance. About ten years ago, Structural Composites teamed with Lockheed Martin to design, build, and qualify a hybrid metal-composite rudder for use on the Navy's Mine Countermeasure ships under ManTech sponsorship. A unique manufacturing process that utilizes low-cost female molds and vacuum / pressure-assisted resin injection was developed for that project. The rudder was shock-tested and installed on MCM-9, which has operated since then without incident. The basic manufacturing technology developed in that ManTech project is being updated and refined for the much larger and more complex DDG 51 rudders. Since the Composite Twisted Rudder (CTR) must be retrofitted on an existing DDG 51, the internal hub casting resembles the fleet rudder design. This HY-80 casting is "pressure fit" onto a tapered shaft. Welded to the casting, a vertical I-beam supports a series of horizontal fins and flanges. The vertical flanges are used to transmit shear loads to the CTR composite skin. A foam core serves primarily as a form for wrapping the dry E-glass reinforcement. A hybrid steel / composite structure is also envisioned for the DDG 1000, which is why the Program Office has supported the effort to field CTRs on a DDG 51. A molded, cavitation-resistant surface treatment is also a key element of this project. Various surface treatments applied as coatings to steel rudders have been unsuccessful. By casting a surface treatment to the CTRs using the female molds, dimensional tolerances and surface smoothness will be much enhanced. Once female molds have been produced, production costs for CTRs are expected to be half that of similar steel rudders and are expected to require minimal maintenance over the life of the ship.

Payoff

Acquisition cost for composite twisted rudders should be half of the cost for twisted steel rudders for roughly $1M savings per hull.

Implementation

The successful design, fabrication, and testing of a DDG 51 CTR will serve as the baseline for development of a DDG 1000 CTR. The procurement process for DDG 1000 will begin this year and will include the purchase of two composite twisted rudders. A well-tested manufacturing plan was delivered to PMS 500 and is serving as the basis for procurement.

Manufacturing Protocols Reduce the Cost of Large DDG 1000 Radomes

S2168 — Low Cost Manufacturing Technology for Very Large Format Low Observable DDG 1000 Radomes

Objective

Future ship communications and radar systems require very large scale low observable (LO) radomes for mission success. The large size of DDG 1000 proposed installations can require seams, grounding, embedded treatments and anti-ice grids. To achieve the desired radome radio frequency (RF) performance levels, laminate defects must be minimized and laminate thickness must be maintained within thousandths of an inch over the entire radome surface area. The cost of these radomes can exceed a half million dollars each, which is a significant portion of the DDG 1000 communications and radar system cost. In order to reduce radome acquisition costs, production radome fabrication yields must be pushed to nearly 100%. This aggressive fabrication goal, while challenging, may be accomplished with hand lay-up autoclave cure manufacturing methods that integrate tailorable ply kits and optimized debulk cycles with both geometric and ultrasonic in-process non-destructive inspection. Robust repair protocols must also be developed to meet the necessary yields.

Payoff

The estimated cost of the radomes for DDG 1000 exceeds $8M per ship. The manufacturing techniques being developed in this project will improve yields by 20%, realizing a cost avoidance of $1.6M per ship. This results in a total savings for DDG 1000 and CG(X) of $21M.

Implementation

This project is developing manufacturing protocols that are transitioning in 2008 and which will directly impact the first two DDG 1000 deliveries. The protocols and project accomplishments were presented to the aperture and ship community at a design review in May 2008. The DDG 1000 deckhouse internal working group is facilitating the transition of EHF TxRx, CEC secondary, IFF, and SPY-3 radomes. Additional radome apertures that will benefit from this technology include the volume search radar (VSR), multi-function mast (MFM), UHF, and HF. The technology partners include PMS500, Johns Hopkins / APL, Raytheon APC, Northrop Grumman, Bath Iron Works, and the contractors and program offices on VSR, MFM, UHF and HF.

PERIOD OF PERFORMANCE:

October 2006 to
September 2009

PLATFORM:

DDG 1000

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Composites

CENTER OF EXCELLENCE:

iMAST

POINT OF CONTACT:

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STAKEHOLDER:

PMS 500

TOTAL MANTECH INVESTMENT:

$655,000

Mechanized Weld Grinding on DDG 1000 to Increase Productivity and Reduce Production Costs and Workforce Hazards

S2172 — DDG 1000 Weld Seam Facing

PERIOD OF PERFORMANCE:

June 2007 to July 2009

PLATFORM:

DDG 1000

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

NMC

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STAKEHOLDER:

PMS 500

TOTAL MANTECH INVESTMENT:

$1,212,000

Objective

DDG 1000 Class ships have a substantial requirement for hull surface fairness both above and below the waterline. The requirement is much more stringent than for past ship construction projects. Hull plating butt welds produce protrusions (reinforcement) that exceed the fairness limits and must be ground flush with the hull. Typically, welds are ground by hand-operated power tools, but achieving the required surface requirements without damaging the adjacent surfaces is difficult. A greater challenge exists in the amount of grinding—an estimated 23,000 linear feet of weld requiring grinding on each ship. Hand grinding tends to be injurious to the workforce, resulting in frequent medical claims. In addition, hand grinding is a labor-intensive process, increasing the overall time to build ships. Finally, the process of grinding must be controlled in order to limit heat input to the welds and limit resulting distortion. Hand grinding these welds, therefore, represents a significant cost when the above factors are taken into consideration. The objective of this Navy Metalworking Center (NMC) project is develop the technology to mechanize the grinding process while avoiding damaging the surfaces adjacent to the welds, as well as reducing workforce hazards such as ergonomic strain, eye injuries, particulate and gaseous emissions, and high-decibel noise levels.

Payoff

A demonstration of the weld seam facing tool confirmed that the 20-foot-per-hour objective removal rate can be accomplished with a COTS tool on a MIL-100S weld. In addition, the project is expected to substantially increase productivity and decrease production costs, including a reduction in lost-time injuries. There is also a potential weight reduction to the ship. A total savings of $723K per hull is projected from productivity improvements and reduction in safety and health costs associated with manual grinding of welds.

Implementation

Two prototype weld seam facing tools, one each at Bath Iron Works and Northrop Grumman Ship Building, will be evaluated and implemented at both shipyards. The weld seam facing alpha tool will be delivered in January 2009, and the final tool will be available in April 2009 for hull and deck applications.

Reduced Labor Hours, Defects, and Scrap Rate for DDG 1000 Superstructure

S2179 — Smart Manufacturing Methods for Carbon / Vinyl Ester Composite Structures

Objective

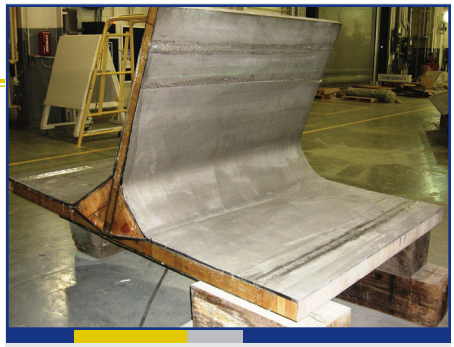
The primary objective of this project was to develop a resin infusion process for fabricating carbon / vinyl ester composites that is predictable, repeatable, and reduces the defect rate experienced with current manual processes. Infusion-related defects are highest among the composites process, which leads to significant rework costs and schedule interruptions. This single-phase effort addressed factors contributing to infusion-related defects: insufficient resin distribution, improper tooling and handling, and incorrect placement of injection ports. To accomplish these objectives, the project team developed computer models of each infusion, provided engineering and design services for panel production, provided hardware to instrument panels with "smart molding" sensors, and fabricated / tested panels to acceptance criteria.

Payoff

The repair procedures for most infusion-related defects are complicated and involved and, in some cases lead to a "scrapping" of the part. This is of particular concern for the DDG 1000 superstructure, which consists of carbon / vinyl ester composite components that are more costly and more difficult to inspect. If successful, the results of this project show promise to increase first-time quality yields and simultaneously reduce defects, scrap rates, labor hours, and cycle time. Discounted labor and material cost avoidance estimates result in a 3-year, 112% return on ManTech investment and a payback period in only 1 deckhouse.

Implementation

Results were implemented at Northrop Grumman Shipbuilding – Gulf Coast (NGSB-GC), Gulfport construction facilities in July 2008. This timeline supported the DDG 1000 lead ship construction efforts, eliminating costly composite joint re-work thus providing significant cost reductions and should support cycle time reductions. These manufacturing process improvements have required little or no contractual action by the customer or other major investments. No additional prerequisite testing, qualifications, or certifications were required for successful implementation at NGSB-GC. The Composite Structures pilot results indicate that joints fabricated using this technology will yield a significant improvement in fabrication quality over historical rework rates, reducing historical rework rates by over 40%; the initial rework rate reductions indicate nearly 6,000 hours saved using this technology. The technology achievements also applied directly to another ManTech project, the ongoing NGSB-GC DDG 1000 Composite Stiffeners project (S2149).



PERIOD OF PERFORMANCE:

May 2007 to October 2008

PLATFORM:

DDG 1000

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Composites

CENTER OF EXCELLENCE:

CNST

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STAKEHOLDER:

PMS 500

TOTAL MANTECH INVESTMENT:

$850,000

Alternate Mounting Methods Reduce Outfitting Time by 20% to 50%

PERIOD OF PERFORMANCE:

June 2007 to December 2009

PLATFORM:

DDG 1000

AFFORDABILITY FOCUS AREA:

Outfitting

CENTER OF EXCELLENCE:

CNST

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STAKEHOLDER:

PMS 500

TOTAL MANTECH INVESTMENT:

$708,000

S2182 — Alternate Mounting Methods for Lightweight Structures

Objective

The objective of this project is to identify, validate, and qualify alternate methods for mounting lightweight (i.e., less than 40 lbs) items onboard Navy ships, specifically the DDG 1000 platform. The conventional, labor-intensive method of welding and bolting adds unwanted cost, time, and weight in new ship construction and repair activities. There are commercially available products that shows promise to reduce cycle time for installation of lightweight outfitting items. Bath Iron Works (BIW) and Northrop Grumman Shipbuilding - Gulf Coast (NGSB-GC) have identified two groups of outfitting items – Category I and Category II – separated by the degrees of difficulty required to mount these items, such as unit weight, purpose, shape, and location. Phase 1 project activities will identify and categorize these items; evaluate and down-select adhesives that meet operational requirements; and conduct testing on Cat-I items. Provided satisfactory go / no-go metrics are achieved, Phase 2 efforts will test Cat-II items.

Payoff

There are dozens of unique items weighing less than 40 pounds (e.g., bulletin boards, coat hooks, mirrors) that are outfit onboard Navy ships and total over 20,000 pieces. The average time to install these items using the current methods ranges from one to four hours; set-up time alone varies from 1.5 to 2.5 hours per shift. To compound the problem, 100% visual inspection of the welded attachments is required for quality assurance. This manufacturing technology issue, if resolved, has the potential to reduce outfitting time by 20% to 50% for approved items, resulting in cost avoidance on the order of $1.5M to $3M per ship for the DDG 1000 program. Findings from this project should be applicable and benefit construction activities at other major shipyards.

Implementation

The potential for cost savings is not only dependent on the adhesive technology, but also upon approval by the appropriate Navy Technical Authority / Codes. As such, implementation will follow a phased approach where the “easier” items to pass inspection and qualification testing will be investigated first. Upon successful project completion, both BIW and NGSB-GC will commence implementation activities at their ship construction facilities. Results will be disseminated industry-wide, as improvements to this methodology are not limited to destroyers, but are applicable to aircraft carriers and other surface combatants as well. Phase II should be completed in late 2009 and BIW anticipates preliminary implementation testing by mid-2010.

Improved Metrology Can Result in Up to a $5M Cost Reduction

S2183 — Hull Fairness and Accuracy Control

Objective

The Navy has increasingly emphasized the lowering of radar cross section on its surface combatant vessels. As such, the shipyards that build these vessels will be held to more stringent requirements than they were previously. Special processes and procedures must be implemented to meet these requirements, which could cause shipbuilding costs to soar if conventional equipment and practices are employed. This ManTech project is investigating and helping to implement the expanded use of metrology instrumentation during the shipbuilding process at Northrop Grumman Shipbuilding – Gulf Coast (NGSB-GC) operations.

Payoff

This effort allows for the investigation of new technologies and software for use in NGSB-GC special processes and procedures, the utilization of which is estimated to reduce rework and improve cycle time, by as much as $5M per DDG 1000 hull, with potential for many other applications Project results will not only facilitate the shipyard's ability to meet enhanced radar cross-section requirements for the DDG 1000, but will improve all facets of accuracy control in addition to combat system alignment procedures.

Implementation

Implementation activities are inherent to this project and will provide NGSB-GC Accuracy Control (A/C) personnel hands-on experience and training on new equipment and software. The project team is comprised of NGSB-GC A/C department leads, and these individuals will be responsible for providing the information needed concerning the current capabilities as well as the gaps in technology and training in the department. The team will perform field trials using the selected equipment to collect data which will support future equipment procurement or lease. This approach will ensure that the A/C department has full buy-in and support for purchasing the new equipment as needed with an anticipated implementation in early 2010.

PERIOD OF PERFORMANCE:

November 2007 to December 2009

PLATFORM:

DDG 1000

AFFORDABILITY FOCUS AREA:

Distortion Reduction

CENTER OF EXCELLENCE:

CNST

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STAKEHOLDER:

PMS 500

TOTAL MANTECH INVESTMENT:

$926,000

Mechanized Welding to Result in Reduced Cost and Cycle Time for Large Marine Structures

PERIOD OF PERFORMANCE:

September 2007 to August 2009

PLATFORM:

DDG 1000

AFFORDABILITY FOCUS AREA:

Schedule Compression

CENTER OF EXCELLENCE:

NJC

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STAKEHOLDER:

PMS 500

TOTAL MANTECH INVESTMENT:

$908,000

S2194 — Weld Development of Large Marine Structures for Hull Integration

Objective

The Navy Joining Center (NJC) is participating in an integrated project team along with PMS 500, Bath Iron Works (BIW), Northrop Grumman Ship Systems (NGSS), and Naval Surface Warfare Center – Carderock Division (NSWC-CD) to develop high productivity, cost-effective, out-of-position, mechanized welding process / procedures for large thick-section, high-strength steel structures for enhanced survivability for next generation surface combatants. The NJC objective is to develop and demonstrate welding procedures necessary to support the required productivity improvements. The technology will initially be implemented on DDG 1000. The welding technologies developed during this project are expected to have wider applications to other Navy ship systems, including thick high strength steel structures on CVN 78 and VIRGINIA Class submarines (VCS).

The goal of this project will be accomplished by leveraging development activity from Navy ManTech Project S1054 “Manufacturing Large Marine Structures”. Further development will investigate several mechanized processes to facilitate out-of-position erection welding. Robust welding procedures will be developed with the preferred processes, and the integration of weld mechanization to maximize first-time quality.

Payoff

The advancements resulting from this project are targeted to reduce welding labor hours and assure first time quality. The result will be cost savings and reduced production schedules. A labor savings of $344K per ship is anticipated.

Implementation

The implementation plan is structured to satisfy the design and construction schedule requirements for the production of DDG 1000. In Phase One of the project, candidate welding processes were screened to identify the best combination of weld properties and operating characteristics. Procedures have been developed for the FCAW and narrow-groove GMAW processes using 100-type consumables. In Phase Two of the project, preferred process combinations that offer the highest productivity for erection welds will be optimized for robustness. This includes the development of process windows and models that can be used to automate each process to the maximum extent possible. Procedures will then be refined, qualified, demonstrated, and validated. The developed technology is to be completed for implementation on DDG 1001. The large structures are to be joined to the hull in early 2010.

Improved Manufacturability of Power Electronic Module Results in an Estimated Savings of $1.5M Per Ship

S2203 — Power Electronic Module Cost Out for the IFTP Program

Objective

The multi-mission DDG 1000 destroyer introduces a wide range of new technologies that will generate tangible breakthroughs in performance and affordability. Advances such as the Integrated Power System (IPS) provide continuous power throughout the ship allowing enhanced survivability by reducing the susceptibility to damage and increasing the ability to fight-through damage. This integrated fight through power (IFTP) is based on a modular power system building block or Power Electronics Module (PEM) that can be connected in parallel or in series to support a wide range of horsepower. This project successfully investigated and implemented cost reduction opportunities for the PEM that will improve the affordability of the IFTP System. The proposed changes have been demonstrated to reduce the materials and assembly price of each system and produced four PEMs which substantially accelerated the manufacturing learning curve. These modules have been used to perform some full power testing and have validated that the design meets the performance requirements. By investigating and resolving anomalies sooner than could be done under normal manufacturing conditions, this project has reduced the risk of performance issues during the First Article manufacturing and test phases so delivery schedules will be met.

Payoff

This effort has achieved the costing objectives without compromising on the product performance, quality, and time to manufacture. Material cost has been reduced by 15% while labor cost has been reduced by 50% resulting in an overall cost reduction of 23% per PEM. Improved manufacturability resulted in a 73% reduction in the touch labor required to build the second generation PEM. These improvements will result in a cost avoidance of approximately $1.5M per ship.

Implementation

The project completed in September 2008, in time for the Production Readiness Review of the PEM system for Bath Iron Works (BIW). The technology developed was successfully transitioned when the PEM manufacturing process and Brass Board testing demonstrated full compliance to the original design requirements. This redesigned second-generation PEM is the design that will be supplied for the First Article Qualification testing for BIW.

PERIOD OF PERFORMANCE:

May 2007 to September 2008

PLATFORM:

DDG 1000

AFFORDABILITY FOCUS AREA:

Electronics

CENTER OF EXCELLENCE:

EMPF

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STAKEHOLDER:

PMS 500

TOTAL MANTECH INVESTMENT:

$1,697,000

Reduced Distortion of Thin Structures Has Potential Savings of $1.5M Per DDG 1000

PERIOD OF PERFORMANCE:

May 2008 to November 2009

PLATFORM:

DDG 1000

AFFORDABILITY FOCUS AREA:

Distortion Reduction

CENTER OF EXCELLENCE:

NJC

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PMS 500

TOTAL MANTECH INVESTMENT:

$495,000

S2205 — Distortion Control for DDG 1000 Thin Structures

Objective

The problems of distortion due to thermal cutting and welding add cost to the fabrication of thin ship structures that are becoming an ever higher percentage of ship content. Distortion of thin panels makes it more difficult to fit and weld subsequent assemblies and units as well as to meet fairness and straightness requirements. This increases ship construction costs and delays schedules. While significant work has been done to reduce distortion, most of this work has focused on the panel line operations. There is a need to apply technology to reduce distortion for subassemblies and units as well as to support the implementation of technologies that benefit the panel line. The objective of this project is to reduce distortion of thin ship structures for DDG 1000 through improved dimensional control of cutting, welding, and handling operations as well as introduction of best practices for tandem submerged arc butt welding, and fabrication of sub-assemblies and units.

Payoff

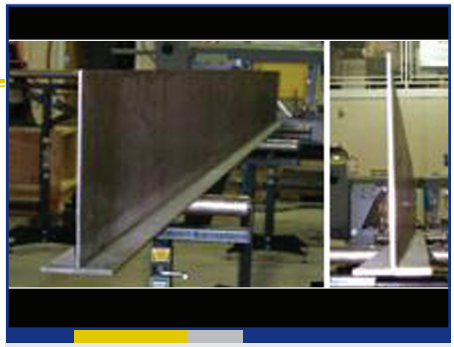
Implementation of the technology developed during this project will reduce the construction costs for DDG 1000 class ships. The cost for distortion of thin structure construction for DDG 1000 class is estimated to be 150,000 labor hours per ship. This is equivalent to $7.5M in construction costs to the Navy. It is estimated that approximately 30,000 labor hours can be saved for a total of $1.5M per ship. Benefits will be applicable to future ship classes as well as to the DDG 1000.

Implementation

The project plan is structured to support Northrop Grumman Shipbuilding - Gulf Coast (NGSB-GC) in the implementation of technologies that reduced distortion for thin plate fabrication on their new panel line and will develop new practices and technologies to reduce distortion for subassemblies and units. The integrated project team's participation in the project supports results that will meet production requirements and lead to successful implementation. The project will complete near-term technical development to impact initial plate fabrication of thin panels for the first DDG 1000 in April 2008. Complete technology transition is expected by September 2009.

Hybrid Laser Arc Welding of HSLA-80 T-Beams to Reduce Costs and Improve Quality of DDG 1000

S2208 — Improved HSLA-80 T-Beams



Objective

T-Beam stiffeners are used extensively in ship construction for decks, bulkheads, shells, and other structural applications. As the need for weight and cost reduction grows, alternate production methods are being considered to improve beam quality, to weld thinner plate materials, and to minimize distortion and the cost and availability of beams for ship construction. The project objective is to determine optimum parameters for hybrid laser arc welding HSLA-80 T-Beams that will reduce production and assembly costs as well as improve T-Beam quality for DDG 1000. Lessons learned from the use of hybrid laser / arc-welded beams will be applied to the project.

Payoff

Laser welded beams offer less distortion and higher weld travel speeds, which result in less rework and lower beam production costs. In addition, the improved beam quality provides better fit-up during shipyard construction, which reduces assembly costs. The higher travel speed and reduced distortion are expected to reduce costs by 25%.

Implementation

This project will develop a weld qualification document for beams laser-welded with HSLA-80. The document will be submitted to American Bureau of Shipping and PMS 500 for approval prior to Bath Iron Works (BIW) using laser welded beams for ship construction.

PERIOD OF PERFORMANCE:

July 2007 to March 2009

PLATFORM:

DDG 1000

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

NMC

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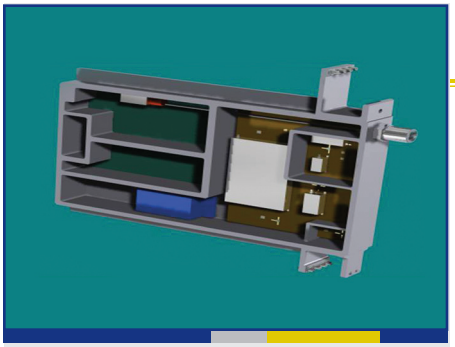
STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$1,279,499

Packaging Methodology Improves Affordability and Sustainability with SMT DREX Modules



PERIOD OF PERFORMANCE:

August 2007 to December 2008

PLATFORM:

DDG 1000

AFFORDABILITY FOCUS AREA:

Electronics

CENTER OF EXCELLENCE:

EMPF

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STAKEHOLDER:

PMS 500

TOTAL MANTECH INVESTMENT:

$1,801,548

S2211 — Digital Receiver and Exciter (DREX) Manufacturing Technology for Radars

Objective

To take advantage of digital beam forming and distributed architectures in the next generation of radars, the need for a large quantity of low cost digital receiver and exciter (DREX) assemblies has become a driving requirement. The main aim of the DREX project is to develop fabrication and assembly processes to support the development of low cost DREX assemblies at the sub-array and element level in a distributed architecture for S and X-Band radar applications. A report on the current REX designs and new DREX definitions was produced early in the project, and a detailed survey report compiled on the multiple COTS/MOTS surface mount technology (SMT) components in a DREX X-Band down converter. A key aspect of this project is the application of established design for manufacturability (DFM) techniques to the DREX design, incorporating SMT design features, and packaging approach. In addition, a detailed packaging study is being performed on the DREX assembly. The most consequential output of the project will be reliability test results of a test vehicle that contains the significant features and package types of the DREX design.

Payoff

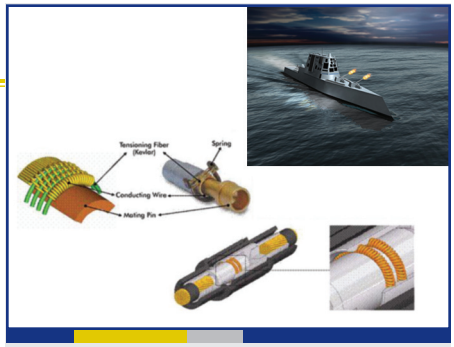
Presently, Receiver Exciter (REX) architectures utilize connectorized component packages with increased volume and weight and higher costs incurred for connectorized packages, cables, and manual assembly. With the development of DREX assemblies in this project, the cost, size, weight, and power (CSWAP) of the radar system will be greatly reduced. The near-term goal is to reduce REX receiver hardware cost by more than 50%. This project examined ways of reducing CSWAP with SMT components on multilayer mixed substrate PWBs. MMIC based designs were also evaluated to even further reduce size and costs. The most important benefit of this project is the ability to support the multiple simultaneous missions requiring multiple waveforms, high dynamic range, and wide bandwidths seen in the continually changing and demanding world of radar processing.

Implementation

The target platform for the DREX assemblies is the DDG 1000 X-Band REX. As part of this project, other target platforms are being reviewed for potential additional implementation. A major goal of this project is to demonstrate the DREX X-Band down-converter module to achieve a TRL 4-5 rating. A follow-on project must occur for the DREX module developed under this project to directly replace the existing X-Band REX hardware. The follow-on work will update the hardware to the current REX form and fit. The DREX X-Band down-converter is intended for insertion onto the fourth ship of the DDG platform.

High Power, High Density Interconnection Program Estimated Cost Savings of $1.8M Per Ship

S2212 — High-Power, High-Density Interconnection Program



Objective

The objective of this project is to develop, fabricate, assemble, demonstrate, and perform limited qualification testing on the next generation power connectors using emerging contact technologies. These connectors will offer significant performance benefits resulting in reduced cost as well as higher reliability. The new technology contacts will allow significantly higher currents (40-400% increase) to be passed over a comparable size traditional electrical contact. For example, a commonly used #20 AWG M39029 contact can carry 7.5 Amps while a common #20 AWG wire is rated for 11 Amps. These new contact technologies are capable of carrying more than 17 Amps per comparable #20AWG contact. This higher current density will facilitate significant cost reductions in the cost of power transmission by reducing the overall number of power cables as well as reducing cost of the remaining cables.

Payoff

This project will help achieve lower interconnection costs by incorporating emerging contact technologies into commonly used MIL SPEC configurations and testing them to ensure they can meet the advertised increased power densities. Reduction in the cost is strongly related to power density, and interconnection hardware, such as connectors, cables, and even small Z-Axis sockets, can be significant contributors to the overall cost of a system. The cost savings resulting from introducing this new technology into circular and rectangular Mil-Spec connectors is currently estimated at $1.8M per ship. These savings result from the anticipated reduction in power cable assemblies and the reduction in cost associated with being able to utilize smaller, less costly connectors.

Implementation

This project will exploit several paths for inserting the resultant technology and knowledge into the DDG 1000 program. The primary path that will be followed is the insertion into specific connector applications. Raytheon's IDS Interconnection Design groups regularly develop application specific connectors. Typically, application specific connectors are required for a high density packaging area such as an Antenna TRIMM Assembly. This assembly is the building block of phased array antennas and therefore has a high volume part. Critical design attributes of TRIMM connectors are low cost, low weight, high reliability, and low insertion force (to facilitate blind mating). The results of this project will match the needed design attributes and will be leveraged for insertion into next generation TRIMM Assembly connectors. A secondary insertion path is integrating the Z-Axis interposer into high density advanced packaging power supply designs. Next Generation Power Supplies utilizing Wide Band Gap (WBG) technology will have significantly higher power densities and require novel power transmission solutions such as those being developed in this program. These assemblies are expected to achieve an 8:1 increase in power density in the very near future. The broadest impact will be the through the creation of industry-level circular and rectangular connector specifications through an organization such as SAE (Society of Automotive Engineers). Raytheon IDS (Integrated Defense Systems) Engineering regularly attends SAE International Aerospace meetings and is actively involved in the Connector Technical Standards committee. This committee is responsible for the creation of new industry-wide connector specifications and review of changes to existing SAE connector specification.

PERIOD OF PERFORMANCE:

July 2007 to March 2009

PLATFORM:

DDG 1000

AFFORDABILITY FOCUS AREA:

Electronics

CENTER OF EXCELLENCE:

EMPF

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STAKEHOLDER:

PMS 500

TOTAL MANTECH INVESTMENT:

$986,000

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LCS Projects
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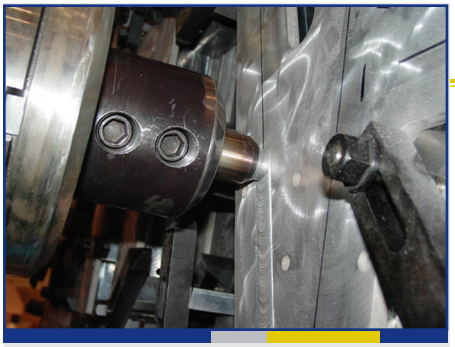
Manufacturing Technology Program

LCS Projects

Shipyard Use of Friction Stir Welding to Offer Advantages in LCS Construction



PERIOD OF PERFORMANCE:

August 2007 to October 2008

PLATFORM:

LCS

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

NMC

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STAKEHOLDER:

PMS 501

TOTAL MANTECH INVESTMENT:

$2,030,000

S2100 — Low Cost Friction Stir Welding of Aluminum for LCS Applications Phase II

Objective

The Littoral Combat Ship (LCS) incorporates significant amounts of aluminum. Friction Stir Welding (FSW) has been proven to be an ideal joining process for aluminum and provides vast improvements over conventional marine aluminum construction methods because it offers decreased distortion, improved joint properties, and reduced production costs. The objective of this project was to develop a low-cost friction stir weld machine and to demonstrate its operation at a shipyard supporting LCS construction.

Payoff

Working with the project Integrated Project Team (IPT), the Navy Metalworking Center (NMC) designed, built, and demonstrated a transportable FSW system that will be transitioned to production use at the shipyard. In operation, the machine essentially serves as an aluminum panel line, forming stiffened panels from edge-welded extrusions. By limiting the design's functionality to the specific needs of extrusion welding, the machine is less costly and provides a quicker return on investment. The simpler machine requires minimal site preparation and is sized for mobility among and within shipyards. By locating the FSW operation at the construction yard, the benefits of FSW are more fully realized because the panels are built to the size needed for construction, rather than being limited to a panel sized for transportation from a remote site. The machine's simplified controls and operation also reduce the skill set and technical support required for the operator.

Implementation

In December 2008, a low-cost friction stir welding machine, along with appropriate supporting data and documentation, will be delivered to the LCS Program for use on-site in construction of Lockheed Martin Team Flight 0 and later Littoral Combat Ships. The machine is expected to be used upon award of FY08 / FY09 LCS ships, which will likely be in FY09. It should be noted that, while the project team (comprised of representatives from the Lockheed Martin LCS team) focused on applications from the Lockheed Martin LCS, the LC-FSW machine is capable of supporting welding operations for a variety of applications, making possible wider application on current and future programs.

Flexible Antenna System Leads to Reduced Cost and Reduced Number of Antennas

S2126 — Flexible Antenna System for Littoral Combat Ship Phase 2

Objective

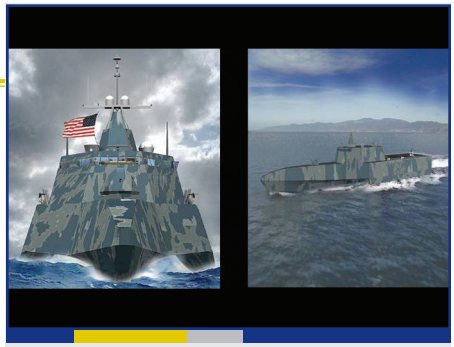
Requirements for next-generation shipboard communications equipment needed to support multiple mission scenarios include performing the following roles: intelligence gathering, surveillance and reconnaissance, mine hunting, interdiction of enemy ships, and personnel transportation. The Littoral Combat Ship (LCS) philosophy is centered on the concept of a reconfigurable platform that will be utilized to counter anti-access littoral threats. To meet the various mission requirements of the LCS, electronic communications equipment tailored for that particular mission will be installed on the ship. This presents a problem for interfacing to the various antennas mounted on the ship. The real estate on the ship is limited, and, therefore, it is not possible to mount every antenna that is required for each possible frequency range and application. Hence, there is a need to define antenna systems to be more flexible in terms of their original operating parameters such as frequency, gain, radiation pattern, etc. The objective of the Flexible Antenna System for Littoral Combat Ship Phase 2 effort is to mature developed demonstration technology to design, build, and test critical hardware components over a section of the 3MHZ-2GHz band and to integrate the hardware to provide a system for transition. The focus is on the development of key technologies that will lead to a significant reduction in cost and the number of communication antennas needed to support LCS mission requirements.

Payoff

The benefits of this project will reduce: the number of antennas required on the LCS, the impact on the antenna farm of reconfiguring the ship for various missions, and the overall cost of the antenna system. This project will develop key technologies that will form a flexible antenna system called the Omni Digital Package (ODP). The system will lead to a significant reduction in the cost and the number of communication antennas needed to support LCS mission requirements. The estimated cost avoidance is $660K per ship, and the antenna farm number will reduce from 26 to 5 antennas. This entails the reduction of the 26 specialized antennas through the integration of 1 multi-band integrated mast (OE-538) antenna and approximately 5 additional ancillary antennas that can send and receive over the range 3MHz to 2GHz. Reducing the antenna count will decrease the maintenance burden of the LCS communications system. A 50% weight reduction is also achievable as fewer antennas will be mounted on the antenna mast.

Implementation

Other programs with flexible communications needs will benefit from the techniques developed in this effort. Northrop Grumman Systems Corporation (NGSC) and BAE are working cooperatively to integrate the combined antenna technology on the LCS platform that is being integrated by General Dynamics (GD). Transition of the ODP system onto LCS is scheduled to occur in FY 2009. The key to successful implementation of the ODP on LCS is coordination by BAE Systems, NGSC, and GD with multiple program management offices throughout the approval process for the design. PMW 170 will provide acceptance of performance characteristics of the ODP, while PMS 501 will provide overall approval of the system for insertion on the LCS platform.



PERIOD OF PERFORMANCE:

April 2007 to December 2008

PLATFORM:

LCS

AFFORDABILITY FOCUS AREA:

Electronics

CENTER OF EXCELLENCE:

EMPF

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STAKEHOLDER:

NAVSEA PMS 501

TOTAL MANTECH INVESTMENT:

$3,571,000

Upgrades to Shipyards' Internal Supply Chain Result in Significant Material Cost Avoidances

PERIOD OF PERFORMANCE:

December 2006 to
February 2008

PLATFORM:

LCS

AFFORDABILITY FOCUS AREA:

Production Engineering

CENTER OF EXCELLENCE:

CNST

POINT OF CONTACT:

Mr. Kevin Carpentier
(843) 760-4364
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STAKEHOLDER:

PMS 501

TOTAL MANTECH INVESTMENT:

$523,000

S2156 — Internal Supply Chain

Objective

Marinette Marine Corporation (MMC), a subsidiary of The Manitowoc Company, Inc., currently designs and constructs vessels for the Navy, Coast Guard, and commercial customers. Its Navy contracts include Improved Navy Lighterage System (INLS) and the Littoral Combat Ship (LCS) prototype. Planning is also underway for the production of Flight 0+ of LCS, which may require the delivery of two to three ships per year. As a result of the volume of work, the mix of customers, and the need to contend with design changes typical of a naval combatant, substantially improved material management processes and systems are required. This project defined and laid the groundwork for implementation of new business and material management systems that will be effective within MMC's specific business and product environment. The ultimate goal was to reduce waste within the existing internal supply chain, reduce costs and provide better data for management.

Payoff

The implementation of improved material management and control methods / systems will directly impact the Navy LCS and INLS programs, as well as Coast Guard and various current and future commercial efforts. When fully implemented, these re-engineered systems and processes are projected to reduce material-related costs by 2.5%, saving $3.1M per LCS. Total estimated material cost savings are $28.7M for the LCS program and $10M for the INLS program; significant labor cost avoidances are also expected. The shipyard anticipates increased competitiveness for Navy work, resulting in optimal resource utilization while minimizing overhead costs.

Implementation

Project pilot implementation results have been documented in the Final Report and Implementation Plan. Analysis of the pilot implementation results identified required process and system refinements and gave rise to a plan for full-scale implementation. The full-scale implementation plan involves both Marinette Marine Corporation as well as their sister shipyard Bay Shipbuilding Company (BSC). Both are part of the Manitowoc Marine Group. The project will be primarily rolled out at MMC with some involvement (approximately 10-20%) from BSC. This will ensure that key topics are discussed and decisions are made while considering the ramifications at both facilities. This will also enable MMC to realize the business improvements on government programs (like LCS) more rapidly.. After the final solution is rolled out at MMC and lessons learned documented, BSC will begin reviewing the MMC-created solution. Changes will be made, as appropriate, to ensure optimal implementation at BSC. An important aspect of the second implementation is to ensure that the user community has 'ownership' of the program and setup. Upon successful and timely project completion, lessons learned will be disseminated industry-wide.

Casting Solution Offers LCS Cost, Construction and Inspection Reduction

S2216 — Littoral Combat Ship (LCS) Bow Castings

Objective

The Navy Metalworking Center (NMC) is working on a project that will simplify construction of the bow section of the Littoral Combat Ship (LCS), the first of the Navy's next-generation surface combatants. The LCS design includes a sharp, raked bow section, which makes connecting the stem bar and adjoining hull plates difficult. This NMC project proposes casting as an alternative method of production that simplifies connection and greatly reduces both the costs and duration of shipyard construction and inspection. A business case analysis will be conducted to determine if a solid or hollow casting should be used, and the casting will be analyzed and prototyped. The project objective is to develop a low-cost bow casting component that provides a much simpler connection between the adjoining hull plate and stem bar, greatly reducing both the costs and duration of shipyard construction and inspection.

Payoff

Casting this component, as opposed to other production methods, will reduce the production cost and labor requirements, decrease machining, improve fit-up, simplify welding and inspection procedures, and reduce re-work. Casting also offers potential weight savings as well as improves the ability of the shipyard to produce multiple ships in the fiscal year, as the current shipbuilding plan requires.

Implementation

The end result of this project will be a replacement solution for the construction of the stem bar detail, which is scheduled to be implemented in FY09 on a LM hull.

PERIOD OF PERFORMANCE:

September 2007 to July 2009

PLATFORM:

LCS

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

NMC

POINT OF CONTACT:

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STAKEHOLDER:

PMS 501

TOTAL MANTECH INVESTMENT:

$1,284,000

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VCS Projects
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Manufacturing Technology Program

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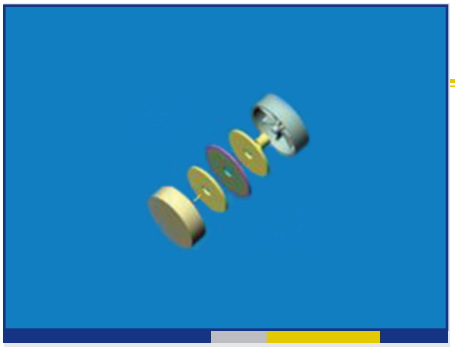
Automated Manufacturing of Fiber Optic Sonar Sensors



PERIOD OF PERFORMANCE:

August 2007 to July 2009

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Electronics

CENTER OF EXCELLENCE:

EOC

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$2,872,000

S0942 — Fiber Optic Conformal Acoustic Velocity Sonar (CAVES) Sensor and Telemetry Manufacturing Technology

Objective

The objective of this project is to reduce the cost of manufacturing Fiber Optic Acoustic Velocity Sensors and related system components. The current Light Weight Wide Aperture Array (LWWAA) utilizes fiber optic pressure sensors. These sensors require a stiff backing plate for operation. Starting with hull 19, a fiber optic based velocity sensor will be utilized, eliminating the need for the costly backing plate. Current methods for fabricating these sensors require significant hands-on labor to wind fiber optic coil assemblies. This project will incorporate design for manufacturing of key components and develop automated manufacturing methods (for example: a dual coil winder machine), written processes, and necessary tools to reduce touch labor costs allowing system components such as delay coils, couplers, acoustic modules and optical switch to become 'productized,' (i.e., produced in required quantities at low cost).

Payoff

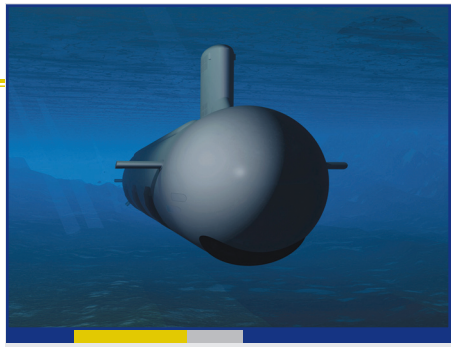
Associated design changes to the electronic controls and interface components designed for use with Fiber Optic (FO) sensors will initially provide system cost reductions when used with current pressure sensor applications. Additional reduction in costs are realized when the FO acoustic velocity sensors eventually replace the pressure type sensors. There will be a reduction in the quantity of lasers in the receiver from 48 to 12 per shipset and Array Plates will be eliminated along with the associated installation costs. In summary, the cost reduction expected with full implementation of FO CAVES technology on hulls 19 through 26 is $12.5M per hull, a total savings of $100M.

Implementation

The manufacturing technology developed in this project is planned for implementation beginning with VIRGINIA Class submarine (VCS) Block IV; SSN 792, hull number 19.The manufacturing technology developed in this project will be implemented at the Northrop Grumman production facility in Salt Lake City, UT. The planned implementation site for the FO CAVES technology is the General Dynamics Electric Boat facility starting in FY15.

Computational Weld Distortion Prediction Reduces Manhours and Costs

S2058 — Weld Distortion Prediction in Submarine Construction



Objective

Weld distortion during fabrication of VIRGINIA Class submarine (VCS) pressure hull sections can cost hundreds of thousands of dollars to repair and cause several months in schedule delays. The current practice of relying on experience-based intuition to specify the overall welding operation is not always effective at preventing weld-distortion-related repair work. This project evaluates existing weld distortion software tools and validates their ability to predict the types of weld distortion likely to occur during the construction of submarine pressure hulls.

Payoff

General Dynamics Electric Boat (GDEB) estimates that on average, 25% of all welding labor costs are spent dealing with weld distortion, either in a preventative or corrective (rework) model. With effective implementation of distortion prediction software, one-half of the extra weld distortion costs can be avoided, resulting in a savings of $200K per hull or a savings of $4M to the VCS construction program. This is considered a conservative estimate since there are direct-support trades such as fitters, grinders, chippers, inspectors, and others who enable the welding process which are not accounted for in this estimate.

Implementation

Computational weld distortion prediction will be used to reduce rework due to weld distortion on future VIRGINIA Class construction and on all future contracts. The technology is expected to be implemented in June 2009, following any approvals required by NAVSEA, and gradually transitioned to welding engineering to assist in predicting weld distortion and identifying practical up-front avoidance solutions. In addition, Manufacturing Work Methods will include sequencing and implementation of analytical tools.

PERIOD OF PERFORMANCE:

November 2004 to December 2008

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Distortion Reduction

CENTER OF EXCELLENCE:

CNST

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$1,231,000

Alternative Damping Materials to Reduce Cost on VCS

PERIOD OF PERFORMANCE:

May 2007 to October 2008

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Nonmetallic

CENTER OF EXCELLENCE:

NMC

POINT OF CONTACT:

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$1,102,000

S2139 — Damping Material Application Improvements Phase I

Objective

The objective of this project is to identify and qualify alternative damping materials that can be applied more efficiently and reduce the total cost of damping material for VIRGINIA Class submarine (VCS). Damping materials are used to reduce vibration. The tiles must meet MIL-PRF-23653, MIL-DTL-24487 and MIL-A-24456 requirements, which include damping characteristics, adhesion strengths in peel and shock, toxicity, flame retardancy and others. The application process for the tiles is labor-intensive and has significant potential for reduction. Materials with more efficient application rates will be identified and qualified for use as damping materials.

Payoff

The benefit of this project is a reduction in the total cost of damping by 20% for VCSs.

Implementation

An alternative material is intended for inclusion on the Qualified Products List (QPL)-23653. This alternate material and identified application processes are expected to be implemented after FY10 on SSN 785 after execution of follow-on phases of the project. The follow-on phases will include modification of candidate systems to overcome any deficiencies identified under Phase I. Phase III of the project will fully qualify and provide necessary information to permit implementation. Involved in this effort are the VCS Program Office, General Dynamics Electric Boat (GDEB), Northrop Grumman Shipbuilding-Newport News (NGSB-NN), and Naval Surface Warfare Center-Carderock Division (NSWC-CD).

Cost-Effective Methods Eliminate Root-Weld Defects in Alloy 625 Pipe Welding for VIRGINIA Class Submarines

S2140 — Alloy 625 Pipe Welding Phase I

Objective

The initial goal of this project was to identify and implement new welding techniques to address the rejection of large diameter, thin-walled alloy 625 pipe welds on VIRGINIA Class submarine (VCS). Navy Metalworking Center (NMC) and the Integrated Project Team (IPT) discovered, however, that improving the fit-up rather than the welding techniques would reduce the weld rejection rate. Specifically, the IPT identified that fabrication of these welds to the existing specifications was not conducive to obtaining acceptable welds. The project provided evidence that currently used practices and techniques, when followed meticulously, and the implementation of "better than specification" fit-up tolerances will result in acceptable welded joints.

Payoff

The improved fit-up specifications identified in this project were successfully applied to SSN 778 at General Dynamics Electric Boat (GDEB). Any future cost savings achieved through application of this improved process will be monitored. These benefits will apply to other submarine classes using large diameter, thin-wall alloy 625 pipe.

Implementation

The project team included shipyards GDEB and Northrop Grumman Shipbuilding-Newport News (NNSB-NN), VCS Program Office (PMS 450), NAVSEA, NMC, the Navy Joining Center (NJC) and Naval Surface Warfare Center-Carderock Division (NSWC-CD). GDEB used the results of this project to refine some of the methods and techniques for pipe fit-up. GDEB implemented these improved processes in July and August 2007 on re-welding of shipboard welds for SSN 778 and will also use them for initial welding applications by GDEB at both Groton, CT and Quonset Point, RI.

PERIOD OF PERFORMANCE:

February 2007 to
February 2008

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

NMC

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$363,000

Composite Manufacturing Processes Reduce Sail Cusp Cost

PERIOD OF PERFORMANCE:

April 2007 to October 2008

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Composites

CENTER OF EXCELLENCE:

CMTC

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$844,000

S2158 — Composite Manufacturing Technology for Reduced Cost Sail Cusp

Objective

The current VIRGINIA Class sail cusp is a stiffened steel structure comprised of numerous pieces which are welded together, filled with syntactic foam, and welded to the sail and hull structure. Considerable material and labor expense is required to fabricate the steel baseline structure due to the sail cusp's complex double curvature and the number of parts required for fit-up. In addition, because the steel sail cusp must be welded to the sail and hull, it cannot be readily removed for maintenance, and the void space is filled almost entirely with syntactic foam to inhibit corrosion which adds additional weight and manufacturing cost.

The Integrated Bleeding Manufacturing (IBMP) and the SCRIMP / VARTM (Seemann Composite Resin Infusion Manufacturing Process / Vacuum Assisted Resin Transfer Molding) processes both offered the potential to reduce the cost of the legacy steel sail cusp by enabling the fabrication as a one piece, unstiffened monocoque composite structure bolted to the sail and hull. The objective of this effort was to demonstrate the feasibility of using these different manufacturing methods by fabricating subscale and/or full-scale manufacturing demonstration articles using each process, and then selecting the most cost-effective approach which met VIRGINIA Class requirements. The approach provided the ability to address fabrication concerns and to establish realistic costs for fabricating and installing a full-scale sail cusp, and ensured that all required performance issues were met. Emphasis was placed on developing processes that showed significant reduction in fabrication costs with respect to the steel baseline.

Payoff

A cost avoidance of $150K per hull will be met or exceeded as a result of this project. A schedule reduction of 14 months to 3 months will also be achieved.

Implementation

This project demonstrated the feasibility of two alternative manufacturing approaches to fabricating the VIRGINIA Class sail cusp. General Dynamics Electric Boat (GDEB) material specifications exist for both manufacturing processes ensuring that, since performance and manufacturing requirements were met for both processes, the transition to implementation is straightforward. Project reviews were held with representatives from PMS 450 and other appropriate NAVSEA technical codes to ensure that all issues and concerns were addressed during the manufacturing technology development process. Both methods are to be implemented on SSN 784.

World Class Material Flow System to Improve Shipbuilding Operation

S2160 — VIRGINIA Class Submarine Material Management

Objective

The objective of this project is to implement a world-class material flow system to support VIRGINIA Class submarine (VCS) construction at General Dynamics Electric Boat (GDEB). Material flow management challenges at the shipyard contribute to high cycle times, excess inventory, low material availability rates, and re-manufacture / re-procurement of rejected, damaged, or lost parts. A new system could improve multiple facets of the shipbuilding operation, including material procurement, scheduling, storage, handling, tracking, and delivery. This includes point-of-use storage, material kitting, and electronic tracking, and could also include a material distribution center that optimizes receiving, inspection, storing, and delivery functions. The project team will develop a current state value map that illustrates process flow and performance metrics; conduct on-site evaluations of companies considered to have "best in class" material flow processes; capture the materials flow future state vision and future state value map; and develop an implementation plan that identifies and prioritizes improvement projects that can bridge the gap between the current and future states.

Payoff

It has been estimated that 30% of a submarine's construction cost is directly related to material procurement and management. The material flow system resulting from this project will contribute to lower cycle times, optimal inventory levels, higher material availability rates, and reduced re-manufacture / re-procurement of rejected, damaged, or lost parts. Given there are approximately 200 warehousing / transportation personnel employed at GDEB, these manufacturing technology issues, if resolved, have the potential to save an estimated $3M annually in labor costs (resulting from a 15% warehouse workforce reduction) plus an additional $150K in lost / damaged materials for each VCS hull constructed. Results from this effort could benefit other shipyards as well.

Implementation

Implementation of a world-class material flow system would improve multiple facets of the shipbuilding operation, including material procurement, scheduling, storage, handling, tracking, and delivery. GDEB has documented successful project results, using a phased approach to implement several material management system improvements in early 2008. The project team conducted a mid-project Value Stream Analysis, adding 5 new activities that could yield significant improvements / savings. A total of 47 initiatives have been identified, with 15 completed or near implementation, another 17 projects in progress. GDEB continues to focus on the most significant opportunity areas, to gain the best value improvements, determined by each cost / benefit analysis. Because material flow processes are not subject to additional testing, qualification, or high-level Navy certifications, the likelihood of further implementation continues to be high.

Note: This project is led by the Center for Naval Shipbuilding Technology (CNST) with a portion of the work performed by the Institute for Manufacturing and Sustainment Technologies (iMAST).

PERIOD OF PERFORMANCE:

June 2007 to March 2009

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Schedule Compression

CENTER OF EXCELLENCE:

CNST and iMAST

POINT OF CONTACT:

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$1,273,000

Design for Production (DfP) Eliminates Wasteful Steps in the Manufacturing Process

PERIOD OF PERFORMANCE:

April 2007 to April 2009

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Production Engineering

CENTER OF EXCELLENCE:

CNST and iMAST

POINT OF CONTACT:

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$751,000

S2161 — Design for Production (DfP 0) Process Improvement

Objective

The objective of this project is to assess and evaluate a new methodology utilizing Design for Production (DfP) process improvement techniques targeting three key areas: cost-based design, design standards / rules, and seamless deliverables. Navy ManTech is funding this two-year, multi-phase effort to ensure the VIRGINIA Class submarine (VCS) production workforce receives accurate, configuration-managed, electronic data that meets their information needs in a timely manner. This project will employ a new knowledge management system and rule-based / cost-based / standardized designs with advanced visualization technology to improve the process for ships' systems. Research activities will capture the best lean manufacturing capabilities; transform them into design standards; apply them during design activities; and produce seamless, "on demand" deliverables derived from 3D product models for cost-effective manufacturing. The investigation will also address implementation issues such as overall process changes necessary to incorporate the new technologies.

Payoff

Upon successful implementation, these improved DfP processes will reduce design / engineering and production labor hours and eliminate wasteful steps in the manufacturing process. Cost avoidances are estimated at $3.65M per year and total $16.9M (present value) through 2012. The resulting technology may be relevant to any shipbuilding new construction program and will provide the design community with manufacturing capabilities, best practices, cost information, and design rules / standards allowing for design decisions that reduce manufacturing, assembly, and testing costs downstream.

Implementation

New technologies will be implemented at General Dynamics Electric Boat (GDEB) in both the Groton, CT and Quonset Point, RI sites at appropriate insertion points. Targeted technologies will be implemented relatively quickly in the short-range phase of the project, and longer-range / systems technologies will be implemented downstream. Project results and lessons learned will be disseminated across the shipbuilding industry as improvements through DfP processes are not limited to submarines but are applicable to aircraft carriers and other surface combatants as well.

Note: This project is led by the Center for Naval Shipbuilding Technology (CNST) with a portion of the work performed by the Institute for Manufacturing and Sustainment Technologies (iMAST).

Outfitting Process Improvements Reduce Manhours by 30%

S2162 — Outfitting Process Improvement

Objective

Reducing VIRGINIA Class submarine (VCS) construction costs to $2B and cycle time to 60 months is key to increasing acquisition and maintaining the submarine industrial base. With the VCS design essentially complete and the bulk of the construction work ahead, one of the greatest opportunities for cost savings and cycle time reduction lie in the outfitting realm. The objective of this project is to analyze the major processes employed during the outfitting stage of construction, prioritize the areas targeted for improvement, and recommend improvement solutions. This includes analyzing foreman time constraints, current scheduling methods and techniques, as well as understanding the various hand-offs of work, information, and material. Results will be documented in a final report and implementation plan.

Payoff

Outfitting activities consume over 30% (1.5M manhours) of the total VCS manufacturing span time. The process / tool improvements resulting from this effort will save an estimated 300K manhours of labor, which equates to approximately $15M per hull. In addition, as much as 30% of the time spent in early outfitting activities could be eliminated. Because VCS construction activities are shared between General Dynamics Electric Boat (GDEB) and Northrop Grumman Shipbuilding – Newport News (NGSB-NN), results from this project have the potential to benefit both shipyards. Other expected benefits of this ManTech project include, but are not limited to: increased presence of foremen in outfitting work cells; increased amount of outfitting activities while cylinder / section is in vertical position; earlier layout work for attachments, inserts, cut-outs, and tank marginal plates; reduced number of manufacturing activities happening in outfitting work cell; and increased efficiency in hand-offs of material, information, and work within and among crews.

Implementation

The VCS Program will directly benefit from the process / tool improvements resulting from this effort, at both GDEB and NGSB-NN ship construction facilities. As soon as these outfitting processes have proven feasible for implementation, immediate specific process adaptation / inclusion begins, as high-level Navy approval and program office involvement is not required. As such, there are a number of outfitting process improvements that have already been implemented and are in use in VCS construction. In addition, the results may be relevant to other new shipbuilding construction programs as well.

Note: This project is led by the Center for Naval Shipbuilding Technology (CNST) with a portion of the work performed by the Institute for Manufacturing and Sustainment Technologies (iMAST).

PERIOD OF PERFORMANCE:

June 2007 to June 2009

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Outfitting

CENTER OF EXCELLENCE:

CNST and iMAST

POINT OF CONTACT:

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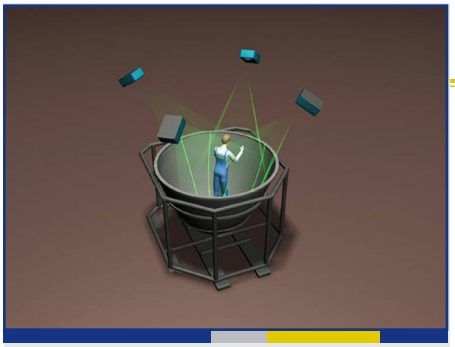
STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$1,486,000

Laser Image Projection Reduces Outfitting Labor by Over 7,000 Manhours Per Hull



PERIOD OF PERFORMANCE:

January 2007 to June 2008

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Outfitting

CENTER OF EXCELLENCE:

CNST

POINT OF CONTACT:

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$605,000

S2164 — Laser Image Projection

Objective

This project investigated and evaluated a new methodology for locating attachments and penetrations onboard VIRGINIA Class submarines (VCS), as the legacy process lacked automation and was extremely labor-intensive. The availability of 3D ship design data in digital format and the development of new layout technologies presented opportunities for considerable improvement. As such, this ManTech project evaluated a new technology which employs an image projection system to pinpoint locations of attachments in portions of a VCS hull.

Payoff

The General Dynamics Electric Boat (GDEB) project team piloted the new technology by attaching approximately 2,300 hangers (electrical and HVAC) – via installment of approximately 4,500 studs – in 13 of 22 hull cylinders. The team found the technology to significantly reduce the layout / fit-up time spent locating shipboard attachments, and completely eliminated the dependency on paper templates for this trade. Based on the completed cylinder pilots, adaptation of this technology is expected to reduce outfitting labor by 7,700 hours per submarine. This represents an 85% reduction compared to manual measurement practices, and will save an estimated $720K per hull and over $14M for the VCS program. In addition to the substantial cost savings, laser image projection technology will also allow layout activities to be conducted earlier in the build sequence, generating a time span savings of 1-3 weeks per major unit.

The GDEB team is continuing to evaluate additional uses of this technology, and in future pilots will include attachment points for piping, sound damping, and other fixed point attachments. The cylindrical shape of the submarine's hull is ideally suited to this technology, but other applications are being considered which could result in cost savings for other Navy construction programs.

Implementation

Project results have been documented in a final report and implementation plan. Included in this plan is the hardware and software needs for full implementation, the process definition for use of the new technology, a training plan for the end-users, necessary changes to the construction schedules, and work orders to allow for locating attachments at the earliest point possible. Cost avoidances and cycle time reductions resulting from this project began immediately upon project completion, as the technology employed for the pilot tests is still in use at GDEB ship construction facilities. To achieve full-scale implementation, capital requests have been placed to buy-out the lease for the image projection system.

Improvements in Material Compressibility Lead to Reduced Cost for CAVES Wide Aperture Array (WAA)

S2166 — Manufacture of DURA Material with Uniform Compression

Objective

Conformal sonar arrays seek to provide an optimally sensor coated submarine with improved stealth at a lower total ownership cost. New technology called Conformal Acoustic Velocity Sonar (CAVES) will replace existing Wide Aperture Array (WAA) technology and will be implemented on the VIRGINIA Class submarine (VCS). With its reduced complexity and number of parts, the CAVES WAA has the potential for significant cost savings over the current Light Weight Wide Aperture Array (LWWAA) system. In addition, the low cost could result in adding this unique WAA capability to the SSN 688 Class. Currently, uniform material compressibility represents one of the most significant design issues for CAVES WAA, and current legacy hull coating processing techniques do not meet the stricter requirements of a WAA-type system. The objective of this project is to develop a manufacturing approach to control the constituents used in the fabrication of DURA material through the use of new processing technologies and approaches. A significant benefit of this approach is the control of a filler constituent, which has a significant impact on the compliance of the material. Another possible beneficial solution is the use of alternate filler, which inherently would provide better control of the material compliance. Other potential beneficial solutions to this approach include improved material processors, better procedures, and more precise waterjet cutting techniques.

Payoff

The engineering ROM cost savings for CAVES over the existing LWWAA is ~$12M per shipset. The ManTech project will enable these savings to be fully realized, and it is anticipated to add an additional $500K savings per shipset in reduced fabrication time and reduced material waste. There will also be undefined cost savings throughout the life of the ship due to reduced rejected material during repairs.

Implementation

The processes and procedures will be implemented in FY12 in the manufacture of the CAVES Array scheduled for installation during new construction. Certification and implementation are being coordinated with NAVSEA.

PERIOD OF PERFORMANCE:

June 2007 to September 2009

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Nonmetallic

CENTER OF EXCELLENCE:

CMTC

POINT OF CONTACT:

Mr. Charlie Rowe
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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$1,629,000

Improved Cladding Workcell Processes to Reduce Submarine Manufacturing Cost

S2169 — Cladding Workcell for Submarine Manufacturing

PERIOD OF PERFORMANCE:

February 2007 to
September 2009

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

iMAST

POINT OF CONTACT:

Mr. Timothy D. Bair
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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$915,000

Objective

The objective is to develop and implement a semi-automated work-cell to achieve improved affordability during cladding of components used in the manufacture of submarines. Current cladding methods are effective but limited in production rate. Fabrication times for components are lengthy, as the facilities layouts are not optimized. The recent requirement to produce a boat in 60 months rather than 84 months, combined with a production rate of two ships per year, necessitate that both output and capacity are increased.

Payoff

The successful completion of this project will result in a reduction in time to fabricate components as well as a reduction in cost due to improved cladding processes and resources. Initial estimates indicate a reduction of 30%, a reduction of 21,500 manhours per hull. Secondary benefits may include improved clad chemistry and corrosion performance, which may impact life-cycle costs.

Implementation

General Dynamics Electric Boat (GDEB) performs cladding operations at both its Groton, CT and Quonset Point, RI facilities. Initial studies will involve an analysis of equipment and facilities and determination of the best cladding practices at GDEB. Laser cladding will be evaluated to determine if it is a feasible alternative based on a cost-benefits analysis. Analysis and designs will be prepared for a work-cell specifically for cladding. The second phase of the project will involve the development of a laboratory-scale cladding system for the testing and analysis of the improved process. The final phase of the project will involve a shipyard-scale cladding system for implementation at GDEB.

Composite Impeller to Result in Cost Savings of $1.3M Per Hull

S2174 — Reduced Cost Impeller

Objective

The current VIRGINIA Class submarine (VCS) impeller is fabricated using a 5-axis machining process on a forged titanium ingot. This is required to achieve the required shape and associated tolerances to meet performance goals. The machining process is very expensive, and the cost of titanium is escalating. The objective of this project is to demonstrate the ability to fabricate a low cost composite impeller that meets all performance requirements and reduces the cost over the titanium baseline component. The technical approach involves the use of high precision composite segments assembled into a finished impeller with no reduction in performance.

Payoff

The projected payoffs for this project are lower acquisition cost compared to the titanium design. It is expected that this project will save $1.3M per hull.

Implementation

The implementation plan involves building a full-scale impeller segments and assembling them into a full-scale impeller suitable for a complete set of qualification tests to be conducted by Naval Undersea Warfare Center (NUWC) by the end of March 2009.

PERIOD OF PERFORMANCE:

June 2007 to May 2009

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Composites

CENTER OF EXCELLENCE:

CMTC

POINT OF CONTACT:

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$1,900,000

Reliable Methods to Assure VIRGINIA Class Submarine Void Fill Reduces Construction Time

S2175 — Epoxy Syntactic Foam for VCS

PERIOD OF PERFORMANCE:

April 2007 to
September 2008

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Nonmetallic

CENTER OF EXCELLENCE:

iMAST

POINT OF CONTACT:

Mr. Timothy D. Bair
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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$115,000

Objective

Voids that occur in the assembly of submarines must be filled with foam materials. The objective of this effort was to develop a syntactic foam and an installation process that meets the property requirements of void-filling foams but does not need to be back-filled. The need for back-filling occurs due to the fact that current void filling foams expand as they cure and then shrink after curing. Since the foam is a solid and bonded to the void walls, it must either crack or de-bond from the wall upon shrinkage. Usually it does both. In order to prevent this, attempts were made to develop a formulation with a lower cure exotherm which would, in turn, reduce the expansion. Although room temperature curing epoxies are used, the large masses result in adiabatic conditions. Since heat cannot escape during cure, the temperature rises, which increases cure rate. As a result, one approach was to evaluate curing agents that cure epoxy with a lower exotherm.

The second approach was to modify the foam installation process. This new process utilizes pre-cast bulkheads that span the entire depth of the void. This breaks up the exotherming mass into small sections, which reduces heat released during curing and therefore the shrinkage. In addition to the foam and installation process development efforts, this project attempted to identify non-destructive evaluation (NDE) technology that reliably determines whether or not a gap exists between the foam and the void wall.

Payoff

The results of this project provide Northrop Grumman Shipbuilding – Newport News (NGSB-NN) with a new approach to mitigate the need to back-fill VIRGINIA Class submarine (VCS) voids after they have been filled. In addition, a reliable NDE method to assure complete void fill resulted. NGSB-NN estimates that implementation of the new technology will reduce VCS construction by 2000 manhours per ship.

Implementation

There is a well-defined process for acceptance of new foams or foam installation processes, with property requirements specified in MIL-S-24167A. This project demonstrated that installation of precast foam sections, with specific gaps between precast sections, allow the entire void to be filled in a single pour without need to backfill. The number and shape of each precast section were determined from the void space structure. NGSB-NN can now prepare the precast foam sections ahead of time, which will significantly reduce the manhours required.

VIRGINIA Class Flood Grates Cost Lowered by $390K Per Shipset

S2180 — VIRGINIA Class Submarine Main Ballast Tank (MBT) Grates

Objective

The VIRGINIA Class submarine (VCS) Program Office, as part of the their overall cost reduction efforts, funded an effort by General Dynamics Electric Boat (GDEB) to investigate and down-select various approaches to reducing the cost of the aft Main Ballast Tank (MBT) flood grate design while also addressing performance issues. This effort considered both composite and non-composite solutions for cost reduction. The ManTech Rapid Response effort developed a composite manufacturing plan for affordable aft MBT composite flood grates as part of the PMS 450 cost acquisition reduction effort. The objective was to demonstrate that form, fit, and function of composite flood grates with identical geometry to existing flood grates are acceptable for shipboard use.

Payoff

The principal benefit of this project is to lower the acquisition cost for the VIRGINIA aft MBT flood grates using an all composite flood grate, resulting in a cost avoidance of $390K per shipset beginning with SSN 778. Projected cost avoidance for VIRGINIA Class for this replacement is $14.4M with a projected return on investment (ROI) of approximately 78:1 for the remaining ships in the class.

Implementation

At the VCS Design Review in May 2007, a request was made by NAVSEA and PMS 450 to get the two flood grates to sea earlier. As a result, the implementation was moved to the SSN 778 which is under construction, and implementation was completed in March of 2008. This installation was performed as a TEMPALT on SSN 778 for the sake of time, and drawing changes were prepared for the next ship in the class to encompass all aft flood grates on the remaining VCS hulls.

PERIOD OF PERFORMANCE:

May 2007 to October 2007

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Composites

CENTER OF EXCELLENCE:

CMTC

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$100,000

Small Weldment Methods Optimize Material Flow and Reduce Labor Hours by 20%

PERIOD OF PERFORMANCE:

August 2007 to February 2009

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Production Engineering

CENTER OF EXCELLENCE:

CNST

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$434,000

S2185 — Small Weldment Optimization Cell

Objective

This ManTech project analyzes, creates a pilot, and recommends a process for the assembly of small weldments from fabricated piece parts. Small weldments at Northrop Grumman Shipbuilding – Newport News (NGSB-NN) are considered to be any structural part – generally up to 4-ft by 8-ft and weighing up to 5 tons – that is manufactured or assembled in the small component fabrication and assembly shops. Current manufacturing and assembly methods for small weldments are outdated, requiring significant cost and time. In addition, the process at NGSB-NN is at maximum capacity, and supporting two VIRGINIA Class submarine (VCS) hulls per year and an aircraft carrier will cause scheduling issues and disruption. The recommended process will provide optimized material flow and work sequences, as well as specify new tooling requirements.

Payoff

At NGSB-NN, small weldments account for approximately 1M manhours on a NIMITZ Class aircraft carrier (FORD Class carriers are expected to require a similar level of effort) and 200K manhours per VCS hull (not including similar work performed at General Dynamics Electric Boat). By evaluating process lanes and optimized tooling and by using state-of-the-art tools, NGSB-NN expects labor reductions of approximately 40K manhours per VCS hull and up to 200K manhours on FORD Class aircraft carriers. If successful, this project could eliminate up to 20% touch labor in the small weldments process, yielding per-hull savings of $2.4M and $12M for the VCS and CVN 78 programs, respectively. Findings from this project should be applicable and benefit construction activities at other major shipyards as well.

Implementation

The project team intends to determine where the most value lies for investments in new tooling for small weldment assembly. The results will initially be used to pursue a new small weldment production facility or an equipment / resource upgrade of an existing NGSB-NN facility using the VCS and CVN 79 Capital Expenditure (CAPEX) program. Implementation priority considerations will be given to the most significant opportunity areas, the length of time required for implementation, funding availability, and the cost / benefit analysis. Given successful project metrics are achieved, NGSB-NN will commence implementation activities at their ship construction facilities in January 2009.

New Fiber Optic Technology Provides Efficient Piping and Conduit Runs

S2188 — Fiber Optic Measurement and Shape Sensing

Objective

Current state-of-the-art position registration devices for piping and conduit runs in ships are bulky, time-consuming to operate, complex, and costly. They require expensive equipment and subject-matter experts to operate. This project will develop a new shop floor technology and provide manufacturing techniques for efficient submarine and ship assembly. It will offer distributed, precise, and real-time position registration for fast and accurate assembly. The objective of this project is to design, build, test, demonstrate, and document a fully functioning prototype fiber-optic position measurement system for transition to the VIRGINIA Class submarine (VCS) production facility for use and shipbuilder contractor Dimensional Control departments.

Payoff

The initial application will target reduction in dimensional control support manhours for ship fitters, machinery installation, pipe shop departments, small weldment fitter shops, and fabrication shops. This is projected to translate into a cost reduction of approximately $800K dollars per hull by the prime contractor and $390K per hull for subcontractor assembly. The benefits to VCS will be to provide a simplified, automated, time-effective, accurately-aligning manufacturing technique for efficient positioning of piping and conduit runs to enable significant cost reduction during production. The new technology will also significantly reduce processing time for photogrammetry, which will support overall schedule reduction.

Implementation

The Fiber Optic Measurement and Shape Sensing System (FOMSS) is scheduled for initial beta testing on SSN 783 on the shop floor at Northrop Grumman Shipbuilding - Newport News starting in January 2010, with full production application on SSN 784.

PERIOD OF PERFORMANCE:

November 2007 to June 2009

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Outfitting

CENTER OF EXCELLENCE:

EOC

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$535,000

Improved Production Engineering Management Tools Result in Reduced Construction Time and Cost

PERIOD OF PERFORMANCE:

September 2007 to
September 2009

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Production Engineering

CENTER OF EXCELLENCE:

iMAST

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$635,000

S2189 — Improved Production Engineering Management Tools

Objective

General Dynamics Electric Boat (GDEB) is committed to compressing the construction span time of a VIRGINIA Class submarine (VCS) hull from 84 to 60 months, thus reducing the unit cost. The objective of this project is to develop a toolset that integrates high-level planning information with detailed resource requirements. The tools developed as part of this project will improve production engineering processes and decision making. The results will reduce the construction span time as well as overall cost. The capability will enable planners and production management to view, modify and update production schedules with capacities.

Payoff

It is expected that the toolset developed as a result of this project will reduce the cost of VCS through the reduction of planning labor hours and a significant reduction of unplanned outsourced work. The cost savings stem from two opportunity areas: labor savings and reduction in unplanned outsourced work. There are approximately 50 planners in production control and approximately $1M unplanned outsourced work. With an estimated 5% reduction in planning / production control labor hours and an estimated 25% reduction in unplanned outsourced work by improving critical resource planning / scheduling and work load leveling activities results, projected savings are estimated at $500K per hull.

Implementation

To ensure maximum transition / implementation, the project team is working closely with stakeholders to ensure that the tools / technologies meet their needs and support the outfitting processes. The new tools and technologies will be transitioned to GDEB as they are completed. The first VCS full hull effected will be the SSN 786.

Joining Techniques Enable Greater Efficiency and Affordability in Sheet Metal Processing

S2191 — Sheet Metal Processing

Objective

Submarine construction includes significant fabrication of sheet metal products comprised of a wide variety of sizes and shapes that necessitate costly hand-fitting and fabrication and utilize manual joining techniques. This project is identifying and developing alternate methods for sheet metal joining and fabrication to improve affordability of the VIRGINIA Class submarine (VCS) that will be implemented at the General Dynamics Electric Boat (GDEB) Quonset Point, RI sheet metal facility. A concurrent engineering methodology along with analysis of process flow is being used to refine designs and manufacturing schemes. A project team has been assembled based on resident technologies and expertise that supports development and implementation activities. Capital improvements will be identified.

Payoff

Based on the level of work associated with sheet metal fabrication at GDEB, a 15% improvement in efficiency is anticipated to result in a cost avoidance of $1.25M per year per hull. This cost avoidance is based on a conservative efficiency estimate. If two hulls per year are factored into the analysis, and the second hull benefits at a level of 50% of the initial 15% improvement, anticipated cost avoidance will be $937.5K per hull per year. Over a three-year period (representing six hulls), the expected cost avoidance will be approximately $5.625M. This estimate ignores secondary cost avoidance associated with reduced part count and inventory, reduced rework due to improved accuracy of components, and increased product flow.

Implementation

The primary implementation site for this technology is GDEB, and a secondary implementation site is at Northrop Grumman Shipbuilding – Newport News (NGSB-NN). The project is being conducted with close cooperation and input from GDEB, with NGSB-NN monitoring progress and having an opportunity for input. The technologies described in this project will compliment the new cutting and forming capabilities recently installed at the GDEB sheet metal fabrication facility. Initial implementation of at GDEB is scheduled in the summer of 2009, keeping with the accelerated build schedule planned for GDEB. Procurement of new equipment resulting from this project has been addressed and is considered acceptable by GDEB based on a positive business case analysis. Funds will be available through internal GDEB investment.

PERIOD OF PERFORMANCE:

April 2007 to September 2010

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

iMAST

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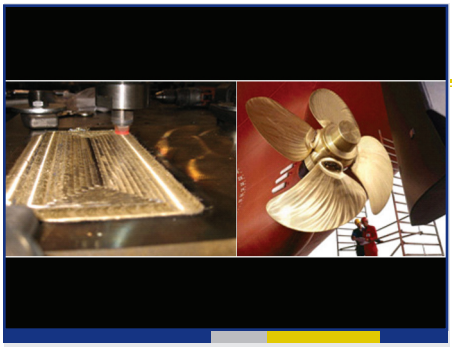
STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$1,075,000

Process Improves Performance and Reduces Repair Costs for Submarine Propellers



PERIOD OF PERFORMANCE:

April 2007 to September 2010

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

NJC

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$505,000

S2196 — Friction Stir Processing of Nickel Aluminum Bronze Propellers

Objective

In-service repair of ship and submarine propellers is a significant recurring cost to the Navy. The current practice is to repair defects and rebuild surfaces by arc welding and then straightening where necessary to restore the correct geometry. Presently welding is limited to gas metal arc welding for the flat position and gas tungsten arc welding for out-of-position repairs. When the propeller can be removed from the vessel, special fixtures are used to position the large parts for flat position welding. Some of the most recent designs make propeller removal extremely difficult and costly, and it is more cost-effective to repair these propellers on the vessel, requiring the use of gas tungsten arc welding which is not highly productive. Therefore, improved repair methods are needed that can reduce the time and cost of repairing propellers as well as extend the life of propellers to increase the time between repair cycles.

In this project, the Navy Joining Center (NJC) is working with the Naval Surface Warfare Center - Carderock Division (NSWC-CD) to develop new joining technologies that improve performance, reduce costs, and reduce the time to repair nickel aluminum bronze propellers. Friction stir processing is a solid state welding process that can be used to repair surface and near surface cracking and porosity and increase the material strength. This process can be combined with a robot to provide a portable method to process new and in-service propellers. Friction plug welding is a portable solid state joining method being investigated for localized repairs. In addition, pulsed gas metal arc welding procedures are being developed to permit high-productivity, out-of-position arc welding of those propellers that cannot easily be removed.

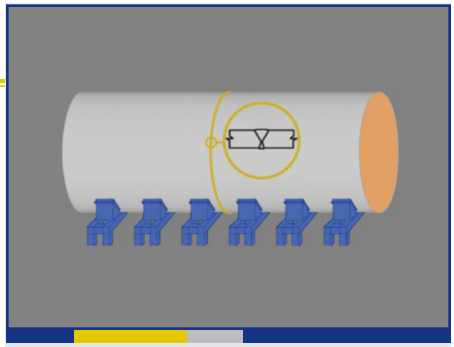
Payoff

The cost of maintaining the existing fleet of propellers is a significant expense to the Navy. Implementing friction stir processing of propellers can speed up the repair of surface and subsurface defects, improve surface layer mechanical properties, locally strengthen critical areas, and reduce residual stresses and associated distortion. In addition, implementation of pulsed gas metal arc welding and portable friction plug welding can permit repairs without having to remove the propeller from the vessel. These improved welding and processing methods will result in labor cost savings; decreased cycle times, and improved propeller performance. It is estimated that friction stir processing alone can save $400K per year in propeller repair costs.

Implementation

The welding and friction stir processing procedures for nickel aluminum bronze that result from this project will be implemented by Naval Foundry and Propeller Center (NFPC) and Wartsila Lips on VCS and Trident propellers. The project supports the certification of the friction stir process as well as the design, construction, and installation of a friction stir processing robot. The project also supports final qualification and demonstration of the processes developed and their transition to user facilities. Implementation will be scheduled to coincide with production and repair schedules at the completion of the project. Initial transition for GMAW repair of propellers will occur in September 2009. The friction stir process procedure is to be transitioned to Wartsila Lips in September 2010. Once the technologies are transitioned, the NFPC and Wartsila Lips will track the implementation of the results of this project and the resulting cost benefits.

Savings Result from Improved Hull Fabrication and Assembly Welding



S2197 — Improved Hull Fabrication and Assembly Welding

Objective

The need for continuous improvement in manufacturing costs of VIRGINIA Class submarines (VCS) is a high priority for the Navy and the shipyards that build VCS. The overall goal is to reduce construction costs from $2.4B to $2B per hull as well as to cut construction time from 84 to 60 months. A key part of this program is reducing ship construction labor costs, including those for welding operations. The Navy Joining Center (NJC), General Dynamics Electric Boat (GDEB), and Northrop Grumman Shipbuilding - Newport News (NGSB-NN) identified opportunities to apply new manufacturing processes and technologies to reduce the costs of welding hull cylinders and subassemblies. A preliminary estimate indicates a goal of 20% reduction in labor for welding and assembly of hull structures is achievable through improvements in technology, processes, and procedures. The objective of this project is to reduce construction costs for VCS by developing and applying technology to reduce welding costs for hull fabrication and assembly. This project is focused on new technology to automate, mechanize, and increase the productivity of fabrication operations that include welding horizontal hull butt joints, hull inserts, and penetrations.

Payoff

Savings will result from improvements in horizontal butt welding, welding of hull inserts, and penetrations through improved joint preparations, mechanization, and increased deposition rates. The estimated cost savings at GDEB are $300K per hull and $628K per hull at NGSB-NN.

Implementation

This project supports construction of VCS and the cost reduction goals of GDEB and NGSB-NN. Transition plans include demonstrations of capabilities that will be combined with the results of risk and business case analysis to provide justification for GDEB and NGSB-NN commitments to implement the results of the project. After Phase II of the ManTech project is complete, GDEB will submit a capital equipment request to implement this welding technology to weld and backgouge hull butt welds being made in the fixed ship position and in the stove pipe position at the Quonset Point facility. Implementation is currently anticipated in December 2010.

PERIOD OF PERFORMANCE:

November 2007 to
February 2009

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Schedule Compression

CENTER OF EXCELLENCE:

NJC

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$601,000

Welding Improvements to Reduce Costs for Structural Fabrications by 1.52M Per Hull

PERIOD OF PERFORMANCE:

November 2007 to
February 2009

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

NJC

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$411,000

S2199 — Structural Fabrication Welding Improvement

Objective

General Dynamics Electric Boat (GDEB) and the Navy are committed to reducing the cost and construction time for VIRGINIA Class submarines (VCS). The cost reduction goal is to cut the cost of construction from $2.4 B to $2B per hull. Part of achieving this goal involves reducing construction time for a single submarine from 84 months to 60 months. A key part of this program is addressing reducing ship construction labor costs, including welding operations. The Navy Joining Center (NJC) is supporting GDEB in this project to reduce the time and cost of structural welding operations. The objective of this project is to reduce construction costs for VCS by introducing new welding methods and technology that increase welding efficiency for structural fabrication operations. The goal is to increase weld deposition rates, thereby reducing welding costs for structural fabrications by a minimum of 20%. The project team is focusing the majority its efforts on the fabrication of large, complex internal structures.

Payoff

Savings will result from improvements in the quality and accuracy of weld preparations through better gouging and mechanization; through increased welding deposition rates and arc time; through use of fixtures, positioning, automation, and mechanization; and through improvements in preheating, welding processes, and equipment. The estimated cost savings at GDEB is estimated at $1.52M per hull.

Implementation

This project supports construction of VCS and the cost reduction goals of GDEB. Results of the risk analysis and business case analysis will provide justification for GDEB commitments to implement the results of the project. After Phase II of the ManTech project is complete, GDEB will submit a capital equipment request to implement this welding technology to weld and backgouge vertical and horizontal welds in the Normal Fuel Oil (NFO) bulkhead that is made at the Quonset Point, RI facility. Implementation is currently anticipated in December 2010.

Alternative Joining Methods Result in Cost Reduction for Sheet Metal Construction

S2204 — Sheet Metal Affordability Improvement for VCS Phase I and Phase II

Objective

The objective of this project is to reduce construction costs for VIRGINIA Class submarines (VCS) by developing alternate joining techniques that enable greater efficiency and affordability in sheet metal construction. A submarine includes a significant number of fabricated sheet metal products, such as electrical enclosures, racks, lockers, and HVAC ducting. While these products have many common features, the submarine requires a wide variety of custom-built sizes and shapes. The variations in the design and size of these components necessitate the use of costly hand-fitting and fabrication methods. Manual processes such as gas tungsten arc welding and riveting involve significant production time and labor cost that could be reduced if more productive methods can be employed.

The Navy Joining Center (NJC) is participating in a project team led by the Institute for Manufacturing and Sustainment Technologies (iMAST) to identify alternate joining techniques to reduce the cost of sheet metal construction. Examples of potential processes include: self-piercing rivets, adhesive bonding, gas metal arc welding, resistance welding, and laser welding. Many of these methods have proven their reliability and affordability for sheet metal applications in automotive and aerospace industries. The initial phase of the project identified resistance spot welding (RSW), gas metal arc welding (GMAW), and adhesive bonding processes as having advantages for sheet metal construction. Resistance spot welding will be qualified for construction of deck plating using existing General Dynamics Electric Boat (GDEB) equipment. These processes will be further developed and demonstrated in a follow-on phase of the project.

Payoff

Based on the level of work associated with sheet metal fabrication at GDEB, a 15% improvement in efficiency is anticipated to result in a savings of $1.25M per year.

Implementation

This project supports construction of VCS and the cost reduction goals of GDEB and Northrop Grumman Shipbuilding - Newport News (NGSB-NN). Transition plans include demonstrations of capabilities that will be combined with the results of risk and business case analysis to provide justification for GDEB and NGSB-NN commitments to implement the results of the project. The developed joining technology is expected to be transitioned to GDEB to support VCS fabrication in June 2009.

PERIOD OF PERFORMANCE:

November 2007 to June 2009

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

NJC

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$325,000

Improved Steel Casting Practices to Reduce Rework and Improve Delivery Time for VCS


Photo courtesy of Northrop Grumman Shipbuilding-Newport News

S2207 — Steel Casting Optimization

PERIOD OF PERFORMANCE:

July 2007 to
November 2009

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

NMC

POINT OF CONTACT:

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$788,000

Objective

The Navy Metalworking Center (NMC) is working with Northrop Grumman Shipbuilding - Newport News (NGSB-NN) and the Virginia Class submarine (VCS) Program Office on the "Steel Casting Optimization Project" to evaluate current VCS hull insert casting problems, such as inclusions (i.e., foreign particles) and entrapped gas. Using the information gathered, test castings will be prepared using identified clean steel practices. The objective of the project is to reduce casting costs and delivery time by improving the cleanliness of high-strength steel during melting and casting, thereby increasing casting quality, improving mechanical properties and reducing rework.

Payoff

Test castings will be prepared using identified clean steel practices, which are expected to lower costs by reducing rework and reheat treatments. This will result in an estimated annual savings of $275K. Estimated savings for improved machining are being assessed. Casting delivery time will also be improved.

Implementation

The clean steel technology developed under this project is being incorporated into NGSB-NN foundry standard operating procedures for hull insert castings and is applicable to other VCS components and marine structures.

Utilization of DfP Principles Reduces Manufacturing, Assembly, and Testing Costs

S2209 — Design for Production Knowledge Tools (DfP 1)

Objective

Recent independent studies have concluded that Design for Production (DfP) is the single most influential factor to reduce ship production cycle time and costs, as ship design processes are not keeping pace with state-of-the-art manufacturing practices. This ManTech project was established to select from current knowledge management process and tools to implement an infrastructure that enables authoring, configuration management, and access to DfP rules and standards. As part of this effort, DfP knowledge management requirements for each design discipline were identified; DfP processes were defined and documented; topic maps for each discipline were designed; both topic and process maps were implemented; and the developed DfP knowledge system was demonstrated. This system will convey producibility criteria to designers who are working ship alterations, technology insertions, and new design development, as well as those improvements dedicated strictly to cutting production costs.

Payoff

In order for the VIRGINIA Class submarine (VCS) program to be affordable, the cost to build one submarine must be less than $2B and must be completed in less than 84 months; current costs exceed $2B and cycle time is closer to 84 months. While this ManTech project is one supporting element of the overall DfP mission, its marginal contribution is estimated to significantly increase the utilization of DfP principles on the order of $0.5M to $1M per hull. The resulting technology will provide the design community with manufacturing capabilities, best practices, cost information, and design rules / standards allowing for design decisions that reduce manufacturing, assembly, and testing costs downstream.

Implementation

The system to provide access to the topic maps requires a computing infrastructure that already exists at General Dynamics Electric Boat (GDEB). However, the purchase of licenses for third party software is also required. The project team plans to transition the prototype system to select users in the November 2008 timeframe. Results will be implemented in GDEB ship construction facilities at Groton, CT and Quonset Point, RI. Cost avoidances and cycle time reductions resulting from this project are estimated to begin as early as production of SSN 784.

PERIOD OF PERFORMANCE:

October 2007 to
November 2008

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Production Engineering

CENTER OF EXCELLENCE:

CNST

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Mr. Kevin Carpentier
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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$439,000

Seamless Delivery of 3D Product Model Data to Reduce Cost Per Hull by Over $500K

PERIOD OF PERFORMANCE:

October, 2007 to March, 2009

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Production Engineering

CENTER OF EXCELLENCE:

CNST

POINT OF CONTACT:

Mr. Kevin Carpentier
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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$393,000

S2210 — Seamless Delivery of 3D Product Model (DfP 2)

Objective

Recent independent studies have concluded that Design for Production (DfP) is the single most influential factor to reduce ship production cycle time and costs, as ship design processes are not keeping pace with state-of-the-art manufacturing practices. The production workforce must receive timely, accurate, configuration-managed, electronic data on-demand; meeting their information needs. To this end, this ManTech project is evaluating evaluate existing construction data models and propose new expanded 3D product model concepts for the VIRGINIA Class submarine (VCS) program. The objective is to develop and implement a DfP "seamless deliverable" that supports manufacturing sequence workbooks.

Payoff

General Dynamics Electric Boat (GDEB) plans to use this expanded digital product model data along with a new knowledge management system and advanced visualization technology to improve the process for design and fabrication of ships' structures. The cost of information duplication, data integration, information formatting, configuration management, data interpretation, and purging will be significantly reduced, on the order of $575K per hull.

Implementation

New technologies will be implemented at GDEB in both Groton, CT and Quonset Point, RI sites at appropriate insertion points. Non-ManTech funding will be required for necessary facility / infrastructure upgrades and special automation tools. Aside from these requirements, there are no additional prerequisite testing, qualifications, or certifications required for successful technology implementation at GDEB. Cost avoidances and cycle time reductions resulting from this project are estimated to begin as early as production of SSN 784.

Submarine Cost Savings Result From Use of New Adhesives

S2223 — Alternate Attachment and Protection Methods

Objective

The objective of this project is to assess, evaluate, and qualify new adhesive technology for attachments, joiner work, and damping tiles on VIRGINIA Class submarine (VCS). The current methods used for these various attachments include riveting, welding, and epoxies – all labor- and time-intensive processes. There are commercially available adhesives that are widely used in the automotive and aerospace industries which may be suitable alternatives to the current attachment methods. The project will investigate potential candidate adhesives and evaluate them in a NAVSEA-approved test plan to assess their suitability for use during VIRGINIA Class submarine construction. Phase 1 of this project will develop a cost benefit analysis for using new adhesive technology, develop product requirements, down-select one or more adhesives, develop a test plan, and conduct product testing.

Payoff

There are over 6,000 various attachments on each VIRGINIA Class submarine, and current installation methods are both labor-intensive and time-consuming. Additionally, use of two-part epoxies generates hazardous material which must be properly disposed. The combined material and labor cost savings associated with use of a new adhesive have been estimated at $230K per submarine. That amounts to $4.6M in savings for the VIRGINIA Class program. Findings from this project should also be applicable to other platforms and benefit construction activities at other major shipyards.

Implementation

The potential for cost savings is dependent on the adhesive technology and approval by the appropriate Navy Technical Authority / Technical Codes. As such, implementation will follow a thorough investigation of adhesive attributes and requirements and successful execution of a NAVSEA-approved test plan. Upon successful project completion, General Dynamics Electric Boat (GDEB) will commence implementation activities at their ship construction facilities in March 2009. Results will be disseminated industry-wide, as improvements to this methodology are not limited to submarines, but are applicable to aircraft carriers and other surface combatants as well.

PERIOD OF PERFORMANCE:

February 2008 to
March 2009

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Outfitting

CENTER OF EXCELLENCE:

CNST

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$516,000

Improved Preparation and Welding Methods of Smaller Diameter Pipes to Reduce Costs on VCS

PERIOD OF PERFORMANCE:

October 2007 to April 2009

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

NMC

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$844,000

S2224 — Pipe Preparation and Welding Methods

Objective

Off-hull, new construction pipe welding methods that involve complex configurations for set-up, positioning, fixturing, and joint preparations are used for small diameter (<3") pipe on VCS. These methods require extensive handling times and manual labor to complete. The project objective is to reduce the cost of construction of the VIRGINIA Class submarine (VCS) by improving pipe preparation and welding methods. This Navy Metalworking Center (NMC) project will demonstrate that by applying improved joint preparation methods, automation techniques and work cell optimizations, the number of pipe construction labor hours will be lowered, and the cost of welding smaller diameter pipe fittings and sections could be reduced by as much as 20%. This project will identify, implement and validate pipe welding process improvements for smaller diameter (<3") pipe fittings and sections on VCS.

Payoff

This project will demonstrate that by applying improved joint preparation methods, automation techniques and work cell optimizations for smaller diameter pipe fittings and sections, the number of pipe construction labor hours will be lowered, and the cost of welding these fittings and sections can be reduced by as much as 20%. Other benefits include reduced pipe joint fit-up and end preparation time and improved materials flow and handling times due to work cell optimizations.

Implementation

Small diameter pipe preparation and welding processes are expected to be implemented in FY10 on SSN 785. Improved pipe fit-up, positioning, fixturing, weld sequencing, and automation methods will be implemented for testing at General Dynamics Electric Boat's (GDEB's) Quonset Point, RI facility and delivered to the VCS Program Office. In addition, since small-diameter pipe exists on other subsurface and surface ships, the automated preparation and welding methods can be applied to other ship systems.

Arc Cladding Techniques Reduce VIRGINIA Class Submarine Production Cost, Maintain Quality Requirements

S2225 — Improved Arc Cladding Techniques

Objective

The current cladding process used by General Dynamics Electric Boat (GDEB) for VCS production is hot wire gas tungsten arc welding, which produces a high-quality clad overlay but at a low deposition rate relative to other cladding processes used in the industry. The current focus on ship construction affordability has elevated the interest in increasing deposition rates by replacing or enhancing the current weld cladding process. The project objective is to reduce the production cost and time on the VIRGINIA Class submarine (VCS) by evaluating alternative cladding techniques that can achieve significantly higher deposition rates while maintaining stringent quality requirements. This project will evaluate up to three alternate arc welding processes: plasma transferred arc welding, gas metal arc welding and submerged arc welding. In addition, efforts will be directed to further optimize the existing cladding process. Project team members include the Navy Metalworking Center (NMC), the Institute for Manufacturing and Sustainment Technologies (iMAST), VCS Program Office, Naval Surface Warfare Center - Carderock Division, and GDEB.

Payoff

This project is evaluating three alternative weld cladding processes in an effort to increase deposition rates from 6 lbs/hour to 10 lbs/hour for a minimum three-layer deposit, while maintaining the stringent VCS quality requirements and limiting GDEB's capital expenditures. In addition, the project will address the optimization of existing cladding process.

Implementation

The findings and recommendations of this project will be provided to iMAST, the lead Navy ManTech Center of Excellence, in January 2009 for inclusion in its overall cladding down-select. The technology chosen will be implemented at Groton, CT and GDEB Quonset Point, RI shipyards.

PERIOD OF PERFORMANCE:

November 2007 to February 2009

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

NMC

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$400,000

Newly Identified Cold Forming Technique for Alloy 625 Fittings Will Save Manufacturing Costs on VCS

PERIOD OF PERFORMANCE:

December 2007 to August 2009

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

NMC

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$1,168,000

S2229 — Cold Forming of Alloy 625 Fittings

Objective

The cost to produce seamless Alloy 625 large-bore elbows and tees is high due to expensive raw material and forming costs. The project objective is to reduce the manufacturing costs of Alloy 625 piping systems on VIRGINIA Class submarines (VCS). This project will demonstrate that a newly identified closed die, cold forming technique can be economically and successfully applied to manufacture large bore, seamless elbows made of Alloy 625, a nickel-based alloy.

Payoff

Substantial raw material cost savings will be realized since this process is expected to use less material per elbow than the existing forming process. An estimated total cost savings per ship set is $660K.

Implementation

The project results will be implemented on VCS SSN 785 and SSN 786. The new manufacturing process is applicable to new construction, overhaul and repair and can be further extended to Alloy 625 piping systems on all Navy platforms.

Simulation Models of VCS Machine Shops to Save Manufacturing Costs

S2230 — VIRGINIA Class Submarine Machine Shop Modeling and Simulation Analysis

Objective

The project objective is to develop simulation models of two General Dynamics Electric Boat (GDEB) machine shops that manufacture the VIRGINIA Class submarine (VCS). The models will analyze the current machine shops at GDEB's shipyards in Groton, CT and Quonset Point, RI and determine the best approach to address both expected and proposed changes for the future (e.g., increased production, new equipment, etc.) The project will evaluate the recommendations for improving production capacity resulting from the analyses and assign priorities for implementation in order to maximize cost savings for the VCS platform.

Payoff

The information gathered and the technologies recommended will streamline production and better manage resources at the shops. Specifically, the project will result in manufacturing savings from reduced labor hours, as well as improved process flow, allocation of work load resources, work efficiency and throughput. Production hours are expected to be reduced by 2.5% at both the Groton, CT and Quonset Point, RI machine shops.

Implementation

Improved process routings and equipment layout will be implemented during and immediately following completion of the project. This project will give GDEB the capability to analyze the current machine shops and determine if there is sufficient capacity to meet the increased demand due to the Navy's 84-60 months schedule reduction and two ships per year initiatives.

PERIOD OF PERFORMANCE:

November 2007 to
January 2009

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Production Engineering

CENTER OF EXCELLENCE:

NMC

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$980,000

Design for ProductionTools Reduces Cost (DfP 4)

PERIOD OF PERFORMANCE:

February 2008 to March 2009

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Production Engineering

CENTER OF EXCELLENCE:

CNST

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$442,000

S2231 — Design for Production Design Alternatives that Reduce Manufacturing Costs (DfP 4)

Objective

Recent independent studies have concluded that Design for Production (DfP) is the single most influential factor to reduce ship production cycle time and costs, as ship design processes are not keeping pace with state-of-the-art manufacturing practices. The best opportunities for savings lie in the manufacture and outfitting realms. To capitalize on these savings, the General Dynamics Electric Boat (GDEB) project team will capture VIRGINIA Class submarine (VCS) best manufacturing practices, the best cost-based design criteria, shop-floor lessons learned, and the best manufacturing capabilities. These shop-floor capabilities will be transformed into both design standards and cost trade-off metrics, that when applied to existing as well as new designs, will result in substantial savings during their first use.

Payoff

GDEB plans to use rule-based, cost-based, standardized designs, along with a new knowledge management system, to improve the process for ships' systems production. GDEB will identify requirements for capturing and delivering design, planning, and manufacturing data needed to support a production system. New DfP forms and tools will eliminate costly operations, standardize designs, and ultimately reduce production costs. This project will focus on the Design for DfP key areas, namely cost-based design drivers and rules by manufacturing shop and design phase as well as work cell specific manufacturing best practices and rules as candidates for design standards, with a conservative savings on the order of $230K per hull.

Implementation

New technologies will be implemented at General Dynamics Electric Boat in both Groton, CT and Quonset Point, RI sites at appropriate insertion points. Non-ManTech funding will be required for necessary facility / infrastructure upgrades and special automation tools. Aside from these requirements, there are no additional prerequisite testing, qualifications, or certifications required for successful technology implementation at GDEB. Cost avoidances and cycle time reductions resulting from this project are estimated to begin as early as production of SSN 785.

Improved Manufacturing Reduces VCS Weapons Cradle Rejection Rate and Rework, Improves Production Costs and Lead Time

R2240 — Weapons Cradle Manufacturing Improvement Rapid Response Project

Objective

The objective of this project is to reduce the cost of each VIRGINIA Class submarine (VCS) by improving the producibility of the submarine weapons cradles. The weapons cradles are used to secure weapons from the time they are loaded onto the ship until just prior to their launch. Because a large amount of welding is used to fabricate the long, thin assemblies, it is difficult to construct them and meet the precise dimensional tolerances.

Payoff

By implementing the project's results, the rejection rate and rework of weapons cradles will greatly decrease, leading to improved production costs and lead time. Navy Metalworking Center (NMC) will examine the current weld processes, detailed drawings, and weld sequencing to identify ways to reduce weld-related distortion. In addition, the team will also optimize welding fixtures to support the manufacturing process.

Implementation

The recommendations of this rapid response project are scheduled to be incorporated into the manufacturing process by Northrop Grumman Shipbuilding Newport News (NGSB-NN) and General Dynamics Electric Boat (GDEB), the VCS design agents.

PERIOD OF PERFORMANCE:

April 2008 to April 2009

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

NMC

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$89,000

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Marine Corps Projects
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NAVY MANTECH
Manufacturing Technology Program

Marine Corps Projects

Steel Casting Offers Reduced Cost and Improved Reliability for M777 Lightweight Howitzer

PERIOD OF PERFORMANCE:

July 2005 to November 2007

PLATFORM:

Marine Corps

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

NMC

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STAKEHOLDER:

JPMO M777

TOTAL MANTECH INVESTMENT:

$876,000

C2049 — Implementation of Steel Investment Castings to Enhance Reliability and Decrease Cost for the M777 Lightweight Howitzer

Objective

The M777 Lightweight Howitzer (LW155) program is a joint effort between the Marine Corps and the Army to replace aging M198 155 MM Howitzers. The program is in full-rate production, with approximately 500 guns expected to be delivered by 2010. Two components on the gun, the 300-pound muzzle brake and the 66-pound tow bracket, are currently welded together. The project's primary objective was to cast the muzzle brake and tow bracket together to reduce cost and improve reliability. Two other key objectives were to mitigate the foundry supplier risk and address quality issues inherent to casting processes.

Payoff

Up to $8M in production cost avoidances are anticipated with the subsequent purchase of the replacement parts over the lifetime of each gun. Introducing additional foundries in the manufacturing chain reduces the supplier's risk and mitigates the risk of fielding. Moreover, eliminating the weld joint and improving casting results in better reliability in the field.

Implementation

The project demonstrated manufacturing of the single piece part to eliminate the welded joint, introduced additional foundries (MetalTek and Wollaston Alloys) to mitigate supplier risk, and developed casting methodologies to improve quality. Once it is verified that the casting meet the required properties, they will be subjected to live-fire field testing by the M777 Lightweight Howitzer Program Office. If the castings pass the field testing, they will be implemented in production.

Composite Armor Panels Reduce Expeditionary Fighting Vehicle (EFV) Support Costs

C2112 — Expeditionary Fighting Vehicle (EFV) Skirt Armor Manufacturing Development

Objective

Skirt armor panels form part of the protection for the Marine Corps Expeditionary Fighting Vehicle (EFV) that is slated to begin low rate initial production (LRIP) in FY12. An enhanced metallic-ceramic composite skirt armor design is being developed for this vehicle. Fabrication of this new design will require much larger panel assemblies than can currently be manufactured. Mechanical fastening is not a viable option due to the additional space claim, weight, part count, and complexity of this type of solution. Therefore, methods must be developed to permit manufacture of the full-sized panels needed for the EFV. The objective of this project is to develop technologies to join armor sub-panels to produce panels that make up the EFV armor skirt. A full-scale set of armor skirt panels for one side of the EFV will be joined and delivered to the Navy / Marine Corps for environmental and durability testing.

Payoff

This project will develop an enabling technology for fabrication of large encapsulated armor structures. The performance of these structures is expected to increase the service life of EFV skirt armor from the current 7 years to 14 years. This will result in a reduction in life-cycle support costs for the EFV of approximately $42M based upon an expected order of 1000 vehicles.

Implementation

The results of this project will be implemented through technology transfer to BAE (Advanced Ceramics Division), General Dynamics Amphibious Operations (GDAMS), and General Dynamics Lands Systems (GDLS) in 2009. It is anticipated that equipment for the joining processes will be commercially available and will be implemented by BAE, GDAMS, GDLS, or an outside supplier.

PERIOD OF PERFORMANCE:

March 2006 to June 2009

PLATFORM:

Marine Corps

AFFORDABILITY FOCUS AREA:

Not Applicable

CENTER OF EXCELLENCE:

NJC

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STAKEHOLDER:

PM AAA

TOTAL MANTECH INVESTMENT:

$445,000

Friction Stir Welding Improves Performance and Reduces EFV Production Cost

PERIOD OF PERFORMANCE:

August 2006 to January 2009

PLATFORM:

Marine Corps

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

NJC

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STAKEHOLDER:

PM AAA

TOTAL MANTECH INVESTMENT:

$755,000

C2152 — Development of Friction Stir Welding for Expeditionary Fighting Vehicle (EFV) Hull Components

Objective

Friction stir welding (FSW) of the lower hull assembly of the Expeditionary Fighting Vehicle (EFV) has the potential to improve the mechanical and ballistic performance while reducing the cost of production compared to conventional robotic gas metal arc welding (GMAW). The FSW process has been demonstrated and tested on 2519 aluminum during prior Navy Joining Center (NJC) projects for the Advanced Amphibious Assault Vehicles (AAAV). A primary task of this project is to develop FSW parameters to join the EFV joint geometries while leveraging the prior ManTech work. This project will also design, build and demonstrate the feasibility of using modular tooling and local clamping to fabricate large structures using FSW. The primary objective of this project is to demonstrate these technologies while delivering a demonstration EFV lower hull assembly for subsequent testing.

Payoff

Implementation of FSW for joining the EFV hull assembly will improve the mechanical and ballistic performance of the structure beyond what is capable with legacy GMAW processes. An improvement of the survivability of the EFV with its impact on the safety of the warfighter is the primary benefit of this project. However, the FSW process additionally provides a 2x improvement in welding cycle time over conventional GMAW. Based on the current EFV production order of 1,013 vehicles, this will represent a cost savings of approximately $1.05M after considering equipment acquisition costs.

Implementation

Friction stir welding and tooling technologies will be transferred to General Dynamics Land Systems (GDLS) where it will be implemented in 2009 in support of the EFV LRIP and continue through the full production order. GDLS has procured a production FSW manufacturing cell to support the EFV that will be fully operational in the second quarter of FY09.

NAVAIR Projects
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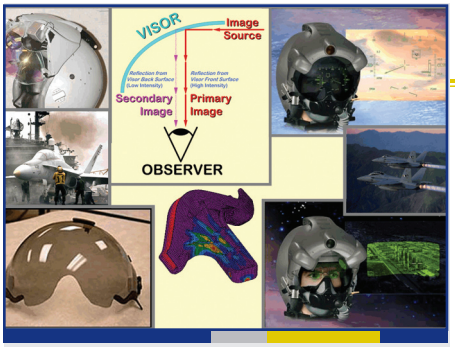
NAVY MANTECH
Manufacturing Technology Program

NAVAIR Projects

New Technology Enhances Manufacturing of Helmet Mounted Display Visors



PERIOD OF PERFORMANCE:

February 2005 to March 2008

PLATFORM:

NAVAIR

AFFORDABILITY FOCUS AREA:

Electronics

CENTER OF EXCELLENCE:

EOC

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STAKEHOLDER:

PMA 265

TOTAL MANTECH INVESTMENT:

$1,670,000

A2076 — Helmet Mounted Display Visor Manufacturing Technology

Objective

This project addressed manufacturing technology enhancements for the production of F/A-18 Joint Helmet Mounted Cueing System (JHMCS) and Joint Strike Fighter (JSF) Helmet Mounted Display (HMD) visors. The project had three main focus areas. The first was the creation of dedicated optical coating capabilities to increase coating throughput, reduce production cycle time, and advance the uniformity and optical performance of the visors' anti-reflective and beamsplitter coatings. The project also sought to improve the hardcoat layer protecting the visors' optical coatings from mechanical damage. The third area was the replacement of the current expensive and labor-intensive composite visor retention tangs with a thermoplastic, injection-molded tang that meets the stringent original mechanical specifications protecting pilots in the event of ejection from the cockpit.

Payoff

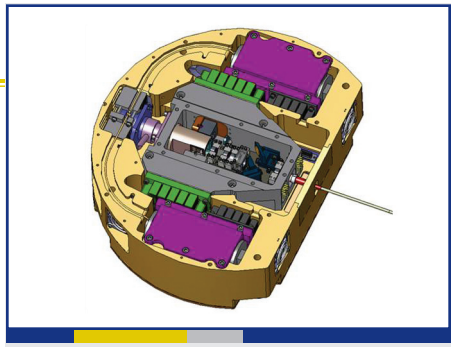
More cost-efficient HMD visors have been made available to the Navy through the Electro-Optic Center's (EOC's) industry partner, Rockwell Collins Display Systems (RCDS), at a higher production yield and throughput. These visors feature a four-fold reduction of distracting secondary reflection intensity, an advanced beamsplitter design, and a more rugged hardcoat layer which protects the visor from scuffs and scratches. The new visor retention tang design reduces the unit production cycle time and cost. The cost avoidance targeted and met by this project was over $300 per unit, an estimated total product life-cycle cost avoidance in excess of $30M for the Navy.

Implementation

Subcontractor Rockwell Collins Display Systems developed, over the course of this project, visor-specific in-house optical coating capabilities and upgraded the visors' hardcoat and the visor retention tangs in close dialog with the stakeholder (PMA 265 F/A-18 and JSF Avionics Program Office) and the system integrator (Boeing). The project yielded F/A-18 and JSF HMD Visor deliverables for the stakeholders, who will evaluate the optical visor performance. The new visor retention tangs passed ejection and windblast testing at NAS Patuxent River and were qualified for production insertion. These verifications complement RCDS's in-house testing conducted throughout the project. The ManTech visor implementation on the F/A-18 and on the JSF commenced in September 2007.

Novel Approaches in Mid-Infrared Laser Technology Allows for Size and Weight Reductions

A2115 — Multispectral Mid IR Lasers for Directional IR Countermeasures



Objective

Advanced Man Portable Air Defense Systems (MANPADS) are a current and ongoing threat to helicopter, tactical aircraft, and commercial airliners. Mid-Infrared laser-based infrared countermeasure (IRCM) systems, such as the Army's Advanced Infrared Countermeasures (ATIRCM), could provide state-of-the-art MANPADS protection for the helicopters, but, due to the system's prohibitively high cost, it is limited to Special Forces applications only. As such, the majority of the rotary wing fleet is unprotected from advanced MANPADS. Current directional infrared countermeasure (DIRCM) systems typically use lasers which require good thermal management systems to remove excess heat which add to the overall power consumption and size of the device. While these devices have proven successful in countering MANPAD threats, the size, weight, and cost of the device makes them difficult to employ on small military aircraft as well as commercial planes. The objectives of this project are to develop the manufacturing technology to address laser manufacturing issues for critical near-term programs such as PMA 272's Strike (F/A-18) and Assault (helo) DIRCM Programs. The technical approach addresses issues such as a reduction in size, improvement in the yield of critical components and subsystems, and a decrease in cost. This may be accomplished by improving the technology, methodology, or materials for the designs currently in use or under development, developing key components and materials, and incorporating pilot production runs to validate technological approaches.

Payoff

Current mid IR lasers for DIRCM applications typically have limitations resulting from their use of nonlinear wavelength converters that require good thermal management that can add to the power consumption, size, and weight of the subsystem. These lasers are also limited in the wavelength range they can emit as well as their output power levels that can make them unsuitable for current DIRCM systems. Using novel approaches in mid IR laser development, a reduction in size and weight of the DIRCM laser transmitter subsystem can be realized while improving the wavelength and power requirements necessary for next generation DIRCM system.

Implementation

Lightweight, low cost mid IR lasers for DIRCM systems are applicable for any aircraft requiring protection against MANPADS threats. PMA 272's Strike and Assault DIRCM programs require mid IR laser subsystems that are both lightweight and low cost so they can be deployed on smaller aircraft. The subcontractor on this effort has extensive experience in current mid IR laser development and a novel technical approach to address the mechanical, electrical, and performance requirements of the Strike and Assault DIRCM programs. Platform insertion is planned as follows: AH-1W – Cobra assault helicopter – 2010; AH-1Z – Cobra – 2010; SH-60 Seahawk – 2010; and F/A 18 – 2012.

PERIOD OF PERFORMANCE:

January 2007 to
December 2009

PLATFORM:

NAVAIR

AFFORDABILITY FOCUS AREA:

Not Applicable

CENTER OF EXCELLENCE:

EOC

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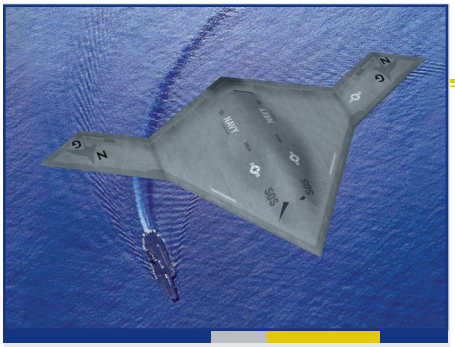
STAKEHOLDER:

PMA 272

TOTAL MANTECH INVESTMENT:

$2,881,000

Advanced Metalworking Technologies Reduce N-UCAS Acquisition Cost and Weight



A2145 — N-UCAS Phase II

Objective

The purpose of this project was to reduce the weight and cost of airframe components through the utilization of advanced metalworking technologies. Two advanced metalworking technologies, advanced High Speed Machining (HSM) and Electron Beam Free Form Fabrication (EBFFF), were down-selected during an initial concept exploration project. Design and development were completed during Phase I. In Phase II, a full-scale significant structural test article consisting of both metal and composite parts was built and tested to demonstrate the applicability of the advanced metalworking technologies. Advanced HSM was used to manufacture ultra-thin, aluminum spars, and EBFFF technology was used to produce lower-cost titanium components.

Payoff

The project demonstrated a total potential cost avoidance of $77,351K for a potential fleet of 150 aircraft and a 16% to 35% weight reduction of affected parts. In addition to reduced fuel costs, the weight savings could lead to performance enhancements such as increased payload and endurance.

Implementation

The project demonstrated the potential for significant acquisition and life-cycle cost avoidance as well as a 16% to 35% weight reduction of affected parts. In addition to resulting in reduced fuel costs, the weight savings could lead to performance enhancements such as increased payload and endurance.

PERIOD OF PERFORMANCE:

November 2006 to April 2008

PLATFORM:

NAVAIR

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

NMC

POINT OF CONTACT:

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STAKEHOLDER:

N-UCAS Advanced Development Program Office

TOTAL MANTECH INVESTMENT:

$1,831,000

Fabrication and Repair of Turbine Bladed Disks Enabled by Translational Friction Welding

A2148 — Translational Friction Welding of Titanium Engine Blisks

Objective

A previous Navy Joining Center (NJC) project (A1008) developed the Translational Friction Welding (TFW) process to attach individual airfoils to the disk hub or blisk for the upgraded F414 aircraft engines for the F/A-18E/F. The development of a procedure to permit the removal and replacement of individual airfoils that may be damaged in service was identified as an additional need. Preliminary work established requirements for further development to successfully achieve the goal of airfoil replacement. This project developed and demonstrated the restoration of the attachment area (stub) and re-welding of an airfoil using TFW. Initial development produced sub-scale, single-sector mock-up hardware. Process development and verification tests were performed comparing methods to produce low heat input build-up of material on a blisk airfoil stub as a preparation for TFW blade replacement. Airfoils were then attached to the restored stubs by TFW to characterize quality, microstructure, and process capability.

Payoff

There will be a cost avoidance for engine repair and overhaul that is presently involved with blisk replacement. The potential for at least $1M / year in savings can be realized by salvage of ten FOD damaged blisks per year.

Implementation

The TFW technology to manufacture welded blisks will be implemented in production by General Electric Aviation USA (GE) during the 4th quarter of calendar year 2008. This equipment and capability is available for both commercial and military aircraft engine applications.

PERIOD OF PERFORMANCE:

July 2006 to April 2008

PLATFORM:

NAVAIR

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

NJC

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Mr. Lawrence E. Brown
(614) 688-5080
lbrown@ewi.org

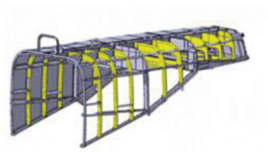
STAKEHOLDER:

PMA 265
PEO (JSF)

TOTAL MANTECH INVESTMENT:

$482,000

Developments in Composite Frames Manufacturing Result in Both Weight and Cost Avoidance



PERIOD OF PERFORMANCE:

April 2007 to April 2009

PLATFORM:

NAVAIR

AFFORDABILITY FOCUS AREA:

Materials /Process Improvements – Composites

CENTER OF EXCELLENCE:

CMTC

POINT OF CONTACT:

Mr. Charlie Rowe
(864) 646-4516
charlie.rowe@scra.org

STAKEHOLDER:

PMA 261

TOTAL MANTECH INVESTMENT:

$3,226,000

A2151 — Composite Frames Manufacturing

Objective

Current frames are costly, heavy, and prone to fatigue and corrosion. The CH-53K Program could benefit from a less expensive composite fabrication technology. Due to the inherent specific strength and stiffness properties of composites, an advanced composite solution will offset potential weight growth and provide a margin for future capability upgrades to the aircraft. The objective of this project is to evaluate and mature candidate manufacturing technologies that offer significant cost reduction over traditional composite manufacturing processes. The technologies include: pultrusion of pre-impregnated material, 3-D braiding of complex shapes, same qualified resin transfer molding (SQRTM), and other advanced RTM techniques. These developments will allow the weight benefits of composite to be realized at economic levels and will enable the CH-53K program to insert composite structures where appropriate.

Payoff

A composite frame solution has the potential to lower O and S (Operations and Sustainment) costs by providing superior fatigue and corrosion properties. The O and S cost could be reduced further by the utilization of standard composite repair methods and procedures currently used. For the CH-53K, composite frames offer both weight savings (against an original aluminum baseline) and potential cost avoidance for certain components, primarily cabin upper beams. A weight reduction potential of 60% is projected for beam structures converted from aluminum to composites, with new manufacturing techniques providing an anticipated 30% cost reduction over conventional composite manufacturing methods.

Implementation

The transition for CH-53K began after the interim project gate review in the second quarter of CY2008. A recommendation to proceed was presented, supported by a business case assessment that balances weight and unit cost avoidance against non-recurring implementation costs. Additional applications requiring greater levels of technology maturation will be evaluated at the project final briefing to be held in early 2009, and prior to the CH-53K Critical Design Review. Major CH-53K airframe subcontractors have been made aware of and are actively participating in the ManTech project as part of their ongoing Cost As an Independent Variable (CAIV) task statement of work. This will ensure not only endorsement of the technology by the Navy and Sikorsky Aircraft but by the program major subcontractors who are responsible for detail design and delivery of major aircraft sections such as the cabin, cockpit, aft transition, etc. The decision to move forward with the beam as the primary design is planned for the fourth quarter of 2008. However, full implementation is not expected until the components are included in the Ground Test Vehicle (GTV), static test article, and ultimately the flight test articles.

Maturing Radome Fabrication Processes to Result in Reduced Cost

A2202 — Asymmetric Radome Manufacturing Technology

Objective

The objective of this ManTech effort is to make advanced radome designs affordable by refining and maturing the manufacturing processes for radome fabrication while maintaining part quality and performance. This project will address the affordability issues associated with materials selection, recurring manufacturing processing costs, as well as quality controls. As a minimum, acquisition and producibility costs will be addressed, including procurement of materials, processing techniques, hand lay-up procedures, laminate configuration, sandwich core construction, and tooling methodology.

Payoff

The principal benefit of this project is the generation of manufacturing solutions for the production of an affordable asymmetric radome design for the EA-18G Wing Tip. To obtain cost benefits, costs are estimated from known material costs and projected manufacturing recurring hours based on the fabrication of demonstration articles.

It is expected that this project will result in the lowering of radome acquisition cost by over $9K / unit and approximately $38K per aircraft (4 units / aircraft). This will be accomplished by employing materials and processing options that can reduce addressable manufacturing costs and reduce unit scrap rates while maintaining performance requirements. In addition, the processes may be usable for other radome applications.

Implementation

This project is part of the EA-18G (PMA 265) technology insertion plan to enhance the overall Electronic Warfare capability for the EA-18G ICAP III Program as well as follow-on engineering manufacturing and development and Future Naval Capabilities (FNC) programs. This project has the concurrence of the EA-18G Program Office. Static load testing, shock testing, acoustic analysis, humidity verification, temperature shock, and other valid tests will be performed. Implementation of the Asymmetric Radome Technology is planned for EA-18G Program Lot 32.

PERIOD OF PERFORMANCE:

June 2008 to October 2009

PLATFORM:

NAVAIR

AFFORDABILITY FOCUS AREA:

Materials /Process Improvements – Composites

CENTER OF EXCELLENCE:

CMTC

POINT OF CONTACT:

Mr. Charlie Rowe
(864) 646-4516
charlie.rowe@scra.org

STAKEHOLDER:

PMS 265

TOTAL MANTECH INVESTMENT:

$1,400,000

Optimized Composites Manufacturing for Wing Skins to Result in Reduced Scrap and Rework

PERIOD OF PERFORMANCE:

June 2008 to October 2009

PLATFORM:

NAVAIR

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Composites

CENTER OF EXCELLENCE:

CMTC

POINT OF CONTACT:

Mr. Charlie Rowe
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STAKEHOLDER:

PMA 265

TOTAL MANTECH INVESTMENT:

$1,500,000

A2234 — Affordable F/A-18 Wing Skin Manufacturing

Objective

F/A-18E/F wing skin production is experiencing continuing manufacturing issues related to ply waviness associated with cocured wing access cut-out steps, also known as rabbets. These issues have resulted in undesirably high scrap rates which have at times threatened aircraft delivery schedules. Two near-term manufacturing technologies have the potential to solve the F/A-18E/F ply distortion quality issues. These are: (1) staging 2 to 4 of the composite plies directly under the rabbet step prior to part cure and (2) die-stamp cutting of the ply-stack which terminates at the rabbet step.

These near-term manufacturing solutions are very desirable for the F/A-18E/F program because they can be fully developed in the 2008 timeframe and implemented into production with a minimum of structural verification testing, thus enabling a rapid resolution to the program's on-going ply distortion quality issues. The project objective is to investigate the two near-term manufacturing technologies to prevent rabbet ply distortion, ply staging, and multi-ply stack stamping, then down-select to the optimum technology for the F/A-18E/F wing skins, and fully demonstrate production capability.

Payoff

Primary benefits are wing skins with reduced scrap, disposition, and rework costs. Additionally there would be operation and support (O and S) cost savings to the fleet. The Return on Investment (ROI) is estimated to be about 5 based on a rough order of magnitude (ROM) cost analysis performed. This ROM estimate was based on 40 aircraft per year, 4 upper wing skins per aircraft, a 10% upper wing skin scrap rate, a 30% part disposition rate, $40K per skin cost, $10K disposition cost ,and a three year timeframe. The government investment used in the ROI calculations was $700K. This does not include any government disposition costs.

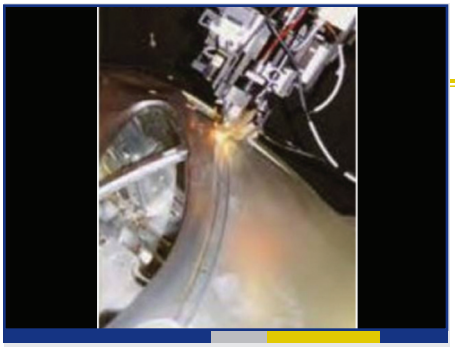
Implementation

The project will fabricate and test a DD62 wing skin article to demonstrate acceptable wing skin fabrication with the improved processes established in the program. There will probably be detailed manufacturing planning changes, including possible process specification modifications and drawing changes depending on the selected technologies. These activities will be conducted in parallel with the ManTech project with associated costs taken care of by the F/A-18E/F Program and part manufacturer. Resulting technology is expected to be implemented into the production line in late 2009.

NAVY MANTECH
Manufacturing Technology Program

NAVSEA – Other Projects

Hybrid Welding Decreases Processing Time and Reduces Rework



S2060 — Hybrid Laser / GMA Pipe Welding System

PERIOD OF PERFORMANCE:

November 2004 to
June 2008

PLATFORM:

NAVSEA – Other

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

CNST

POINT OF CONTACT:

Mr. Kevin Carpentier
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STAKEHOLDER:

PEO (Ships)

TOTAL MANTECH INVESTMENT:

$2,143,000

Objective

Current pipe welding procedures involve beveled joints using flux-core arc welding (FCAW), gas-metal arc welding (GMAW), or gas-tungsten arc welding (GTAW). These multiple-pass welds are very time-consuming, and the frequent starts and stops are a source of many defects. The Applied Research Laboratory (ARL) at Penn State University led a team that included National Steel and Shipbuilding Company (NASSCO) to design and build a hybrid laser / GMAW system that combined deep keyhole penetration of laser welding with the high metal deposition rate of GMAW, enabling single-pass, butt welding of pipe. NASSCO conducted a seven-month demonstration of the hybrid system using shipyard welders in a production environment as part of the T-AKE construction program.

Payoff

The hybrid method will significantly decrease weld processing time and is expected to reduce rework by reducing the number of weld defects that result from the frequent starts and stops that take place during multi-pass welding. If systems were utilized to full capacity, with all machining performed at the shipyard, the savings could be as much as 23% of 47,000 hours or 10,810 hours per year. If pre-machined fittings were used, the savings can be estimated to increase to 23,030 hours per year. With conservative labor and pre-machining costs considered, annual savings can be estimated at $1.78M, not taking into consideration process improvements and the potential reduction in weld repair / rework costs.

Implementation

System demonstrations and technology transfer activities were conducted throughout the project's duration. A significant result is the first qualification of hybrid laser welding by the American Bureau of Shipping in the U.S. This system was the first demonstration of hybrid laser welding in a U.S. shipyard, with this being the first production components hybrid-welded in a U.S. shipyard and installed on a U.S. ship. The hybrid process has been examined and developed for this application, and the process has been qualified through the American Bureau of Shipping for a wide range of pipe schedules. A system to realize this application was specified, designed, built, and piloted in General Dynamics NASSCO Shipyard in November 2007 and subjected to a 7-month evaluation on the production floor. The lessons learned from the system evaluation have been documented to benefit future efforts. The project was completed in June 2008, with the transfer of system components to the ARL facility for follow-on development. This project's achievements will support a broader application of laser use in welding applications.

Automated Pipe Nesting Technology Improves Efficiency in T-AKE Pipe Spool Manufacturing

S2107 — Nested Material Manufacturing Technology Improvement

Objective

The shipbuilding industry is unique in that production is typically for a limited number of ships at a time and each ship is composed of thousands of specialized parts and assemblies. As shipyards continue to pursue more efficient fabrication processes, especially pipe fabrication, they gravitate more toward automation. However, automation alone does not solve the problem. Traditional labor-intensive planning and routing procedures are insufficient and do not take into account the variables of individual process time, work station capacities, emerging engineering design, schedule changes, and shop level loading considerations. This project developed an automated planning and control system in the National Steel and Shipbuilding Company (NASSCO) Pipe Shop that enabled the efficient handling of pipe spool fabrication in a flexible manufacturing environment reducing costs and scrap.

Payoff

The NASSCO team recognized that integrated work planning tools would increase production and reduce material requirements in the pipe spool fabrication process. This project resulted in overall improvements in scrap rate reduction, lowering the recurring cost of manual pipe nesting and work planning, and the end-to-end production efficiency of pipe spools. The performance of the Pipe Shop Management System (PSMS) exceeded initial expectations by not only planning work, but also accomplishing it significantly faster and more accurately than production had previously experienced. Though only recently implemented, NASSCO has already observed several performance benefits, including reduced planning labor ($44K per year), reduced scrap remnants ($1M per year), and increased production efficiency ($300K per year).

Implementation

Once the specification for the Pipe Shop Management System (PSMS) was completed, the initial production implementation plan was developed and included in the design. Software application testing followed, and the project culminated with a six-month pilot implementation of the PSMS on NASSCO's T-AKE Program and was completed in February 2008. The system is now fully implemented in NASSCO's current pipe shop operations.

PERIOD OF PERFORMANCE:

February 2006 to
February 2008

PLATFORM:

NAVSEA – Other

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

CNST

POINT OF CONTACT:

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STAKEHOLDER:

PEO (Ships)

TOTAL MANTECH INVESTMENT:

$667,000

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Energetics Projects
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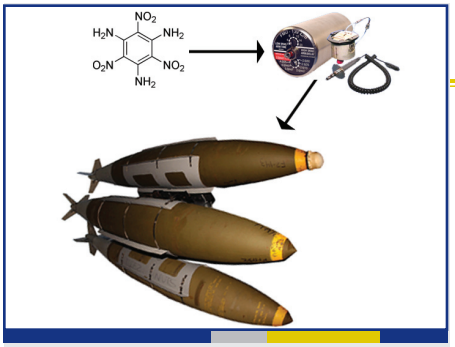
NAVY MANTECH
Manufacturing Technology Program

Energetics Projects

Synthesis Technology Provides Readily Available Domestic Source of TATB Explosive



PERIOD OF PERFORMANCE:

November 2000 to
January 2008

PLATFORM:

Energetics

AFFORDABILITY FOCUS AREA:

Not Applicable

CENTER OF EXCELLENCE:

EMTC

POINT OF CONTACT:

Mr. Charles R. Painter
(301) 744-6772

STAKEHOLDER:

PMA 201

TOTAL MANTECH INVESTMENT:

$3,018,000

A0983 — Alternative Manufacture of Energetic Material TATB

Objective

Triamino-trinitrobenzene (TATB) is one of the least sensitive explosive materials known and is a primary, critical ingredient used to meet Insensitive Munitions (IM) requirements in the booster explosive PBXN-7, used in bomb and missile fuzes. However, availability and cost issues have limited its use. All U.S. sources for this material have ceased production, primarily due to environmental issues with the current manufacturing routes. The objectives of this project were to investigate and evaluate several alternative TATB chemical synthesis processes, determine the best approach, scale-up, and demonstrate the process at full production scale.

Payoff

This project culminated in a demonstrated, domestic manufacturing capability at ATK Launch Systems at the 500-gallon production scale. Subsequent to the start of the ManTech project, BAE Systems, Ordnance Systems Incorporated (OSI), contract operator of the Holston Army Ammunition Plant, independently had success in developing another synthesis route to manufacture TATB. The completion of this project provides the Navy and DOD a domestic source for this critical material and replaces the only previous source, BAE Systems, Royal Ordnance in Bridgewater, UK, that finally ceased production in December 2005 and closed in 2006.

Implementation

Qualification testing of PBXN-7 made using both ATK and OSI TATB resulted in reduced shock sensitivity which can cause reliability problems in fuzes. Therefore, the Navy, Air Force, Army and DOE have teamed to develop manufacturing options to resolve this issue. The team is vigorously pursuing the following options: 1) optimization of the ATK and/or OSI processes to yield acceptable TATB; 2) evaluation of new synthesis route at OSI; 3) reformulation of PBXN-7 using current ATK and OSI TATB; and 4) re-establishing the Bridgewater process at OSI.

This work is scheduled to be completed in FY09, and one or two options will be selected to produce acceptable TATB. Requalification of the PBXN-7 is scheduled in FY10. TATB is needed to sustain current acquisition programs for FMU-139 and FMU-152 fuzes used in Navy and Air Force bombs (BLU-110, BLU-111, BLU-113, BLU-117, BLU-126, MK82, and MK84). Other users of PBXN-7 include FMU-143 (BLU-116, BLU-109), FMU-148A/B (Tomahawk), FMU-155/B (SLAM ER), MK436 fuze (MK146 warhead 2.75) and JSOW. TATB is also a primary component in IM fuze booster PBXW-14 in the M734A1 fuze for the Army (and USMC) M934 120-mm mortar.

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Continuous Extrusion Process Enhances Safety and Efficiency of Propellants

S0984 — Flexible Manufacturing of Nitrogen Based Gun Propellants (Flex Man)

Objective

Continuous processing is a revolutionary lower-cost technology being used for the manufacture of gun propellants and other energetic materials. Navy systems such as the extended range conventional 5 inch round and the Advanced Gun System (AGS) require higher-performing gun propellants to increase stand-off range and to engage targets further inland. Novel propellant formulations and geometries, such as propellants that include high nitrogen ingredients and co-layered propellants, have the potential to offer this higher performance while also decreasing gun barrel erosion and improving munition insensitivity. The objective of this project is the development of a continuous process to manufacture low cost, high volume nitrogen-based gun propellants, including a co-extrusion process for the manufacture of co-layered propellants.

Payoff

The primary focus is to establish the manufacturing capability to produce energetics using continuous extrusion processes. As an added benefit, cost avoidances of approximately 25% are historically realized when switching from conventional batch processes to a continuous extrusion process. Operating efficiency is obtained by replacing numerous labor-intensive operations of the batch process with a single automated process. Lower environmental costs are derived from reducing explosive waste and eliminating waste solvents. Enhanced operator safety is realized because the continuous process incorporates remote and automatic control. Improved reliability results from better dimensional control of the propellant and improved product quality.

Implementation

The process development and demonstration will be conducted at Naval Surface Warfare Center - Indian Head Division (NSWC-IHD) by late 2010. This technology has the potential to be implemented for Navy programs being developed in parallel with the project such as an extended range conventional 5-inch round, the High Energy BB round, and the Extended Range Long Range Land Attack Projectile (ER-LRLAP) for AGS. The Extended Range Munition (ERM) Program is in the process of being restructured, so qualification and production dates are unknown at this time, but the technology will be available when those dates are determined. After a successful demonstration, the process will be transitioned to an energetics manufacturer. If a willing industrial source cannot be found, NSWC-IHD will implement this technology into production.

PERIOD OF PERFORMANCE:

April 2001 to October 2010

PLATFORM:

Energetics

AFFORDABILITY FOCUS AREA:

Not Applicable

CENTER OF EXCELLENCE:

EMTC

POINT OF CONTACT:

Mr. Charles R. Painter
(301) 744-6772

STAKEHOLDER:

PEO (IWS) 3C

TOTAL MANTECH INVESTMENT:

$6,796,000

Real-Time Analytical Tools Allow Optimized Process Scale-up of State-of-the-Art Energetic Materials

PERIOD OF PERFORMANCE:

June 2006 to March 2010

PLATFORM:

Energetics

AFFORDABILITY FOCUS AREA:

Not Applicable

CENTER OF EXCELLENCE:

EMTC

POINT OF CONTACT:

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STAKEHOLDER:

PEO (IWS) 3C

TOTAL MANTECH INVESTMENT:

$3,783,000

S2214 — Flexible Manufacturing of Novel Energetic Materials (Flex NEM)

Objective

The manufacturing processes and cost of emerging, novel energetic materials poses a challenge for transition into fleet applications. The requirements for high performance gun propellants require the use of novel ingredients and processing techniques. This project will develop and establish a flexible manufacturing capability using real-time analytical tools for the optimization and scale-up of state-of-the-art energetic materials such as Guanidinium Azotetra¬zolate (GUZT), one of several specific energetic ingredients being addressed (GUZT is a high-nitrogen material with potential application as a burning-rate modifier in gun propellants and ingredient for explosives. It appeals to the energetics community because of its straightforward synthesis and relative insensitivity to friction and impact).

Payoff

The principal benefit from this project will be a flexible manufacturing capability for producing a variety of energetic material ingredients for propellants and explosives that provides high energy, low erosivity ingredients for propellant formulations for current and future Navy gun systems. Real-time analytical tools aid in producing these state-of-the-art materials at the multi-kilogram scale to support research and development formulation efforts and are easing the transition from development to production. Based on the use of these tools, synthesis modifications can be incorporated to lower manufacturing costs by improving operating efficiency and enhancing safety. The use of automation also reduces human error as well as removes the operator from a hazardous environment. Optimizing the synthesis process will reduce labor cost as more GUZT is produced per batch. The overall cost avoidance is based on reduced labor requirements, increased product yields and quantities, reduced explosive waste, and improved product quality. The increased capabilities afford a more efficient, advanced manufacturing process for GUZT.

Implementation

The process will be ready for testing at the 500-gallon scale in FY09. At this time, the intent is to solicit industry partners for interest in manufacturing GUZT at their respective facilities. In FY09, a technical data package will be provided to Navy ManTech for transition of the process to any interested industry partner in support of Advanced Gun Propellants. If a willing industrial source cannot be found, NSWC-IHD will implement this technology into production. This technology is planned for Navy programs such as an extended range conventional 5-inch round and the Extended Range Long Range Land Attack Projectile (ER-LRLAP) for Advanced Gun Systems (AGS).

REPTECH Projects
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NAVY MANTECH
Manufacturing Technology Program

REPTECH Projects

Laser-Based Repair Reduces Life-Cycle Cost and Optimizes Operational Readiness of Submarines

S0994 — VLS Tube Repair

PERIOD OF PERFORMANCE:

December 2000 to
December 2008

PLATFORM:

REPTECH

AFFORDABILITY FOCUS AREA:

Not Applicable

CENTER OF EXCELLENCE:

iMAST

POINT OF CONTACT:

Mr. Timothy D. Bair
(814) 863-3880
tdb14@psu.edu

STAKEHOLDER:

COMSUBPAC
NAVSEA (SEA 04X2E)
NAVSHIPYD – Pearl Harbor

TOTAL MANTECH INVESTMENT:

$1,575,000

Objective

Vertical Launch Systems (VLS) on 688-Class submarines are experiencing corrosion damage in Vertical Launch Missile tube areas. This affects both the weapon system's availability during deployment and maintenance costs pierside. Severe corrosion can result in missile tubes placed out of service until the vessel returns to port. At a minimum, this corrosion damage is resulting in an increased maintenance burden with significant repair costs. The objective of this project is to qualify a laser cladding process to apply a superior method of corrosion protection to the affected VLS tube areas using technology developed at the Applied Research Laboratory (ARL) at Penn State University.

Payoff

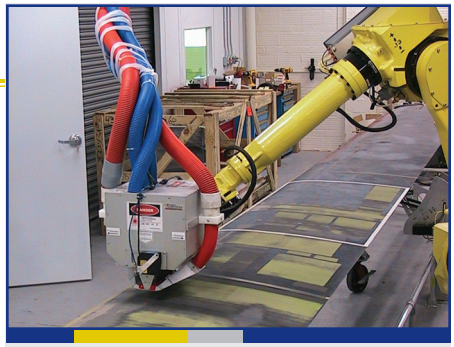
Benefits of the laser cladding process include a 62.5% reduction in repair time and an increase in durability to a level equivalent or better than the originally delivered tubes. A laser-based repair will decrease repair costs by reducing the labor necessary to accomplish a repair and by extending the time between repairs. Operational readiness and weapon system reliability will be optimized by this improved process while reducing life-cycle costs. Each submarine has 12 VLS tubes. Assuming shipyard worker direct time to amount to $100 per hour, the cost avoidance per tube will be $18K for a total of $216K per sub. Seventeen subs in the Pacific Fleet will benefit from VLS tube recladding in the next five years, according to schedule availabilities, for a total cost avoidance of over $3.6M.

Implementation

The repair process will be implemented at Pearl Harbor Naval Shipyard (PHNSY) and Intermediate Maintenance Facility. Naval Undersea Warfare Center (NUWC) Keyport will deliver an automated tool that will prep, weld, and grind the VLS seal band area. The Institute for Manufacturing and Sustainment Technologies (iMAST) has established and reported baseline corrosion data to guide the selection of repair material. SEA 05M approval procedures have been established as a supplement to MIL-STD-248 pending any necessary further approval. Regular team meetings are held with formal program reviews to keep the implementation on track. Beta system tool hardware is complete, and integration is nearing completion. The final delivery of the system to PHNSY is expected to occur in December 2008.

New Depainting Process Proves To Be Cost-Effective and Environmentally Friendly

A1014 — Helicopter Blade Refurbishment



Objective

Current blade stripping procedures are labor-intensive, time-consuming, and expensive. The objective of this project has been to analyze available refurbishment methods, select an optimal cost-effective technology process, and help implement the designated process for application on Sikorsky CH-53E helicopter main rotor blades inducted at Fleet Readiness Center East - Cherry Point (FRC-CP). Laser-based coating removal (LBCR) technology has been demonstrated as a viable, environmentally friendly alternative to conventional depainting techniques. Testing, in accordance with Sikorsky Aircraft specifications, indicates no damage to the substrate will occur from the laser stripping process. System specifications have been developed and the Naval Undersea Warfare Center (NUWC) Keyport, serving as the system integrator, has now completed a prototype system. The plan is to implement an automated system at FRC-CP in December 2008.

Payoff

The successful completion of this project will result in a viable cost-avoidance. It will also have a beneficial environmental impact on worker health and safety. The qualification of a LBCR original equipment manufacturer (OEM)-approved technology will result in an estimated reduction in processing time from 20 hours per blade to less than two hours per blade (a 90% reduction). A cost avoidance of approximately $908K per year is anticipated.

Implementation

After successfully proving the new process is cost-effective and meets requirements established by the Naval Air Systems Command (NAVAIR), the Institute for Manufacturing and Sustainment Technologies (iMAST) has worked closely with the system integrator and FRC-CP personnel to design a system that accommodates production flow. Process Qualification Testing and local FST Process Approval was successfully completed at NUWC Keyport in April 2008. Functional testing of the automated rotor blade depainting system has been conducted. It is anticipated that a full-scale production system will be installed and integrated at FRC-CP for operational analysis by December 2008. Working with the National Center for Manufacturing Sciences / Commercial Technology for Maintenance Activities (NCMS / CTMA) team members (Sikorsky, General Lasertronics Corporation, Naval NUWC Keyport, and Koops System Integrators) adds additional technical guidance, financial support, and eventual commercial suppliers for the technology transition.

PERIOD OF PERFORMANCE:

June, 2002 to January, 2009

PLATFORM:

REPTECH

AFFORDABILITY FOCUS AREA:

Not Applicable

CENTER OF EXCELLENCE:

iMAST

POINT OF CONTACT:

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tdb14@psu.edu

STAKEHOLDER:

FRC-CP (Cherry Point)

TOTAL MANTECH INVESTMENT:

$833,000

Erosion Resistant Coatings Avoid Costs and Improve Service Life of Aircraft Compressors

PERIOD OF PERFORMANCE:

April 2005 to March 2009

PLATFORM:

REPTECH

AFFORDABILITY FOCUS AREA:

Not Applicable

CENTER OF EXCELLENCE:

iMAST

POINT OF CONTACT:

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STAKEHOLDER:

NAVAIR

TOTAL MANTECH INVESTMENT:

$1,650,000

A2087 — Erosion Resistant Coatings for Stage 1 Compressor Components

Objective

When aircraft take off and land, vortexes are formed which often result in the ingestion of hard solid particles of sand, dust, and ice into the air flow. 1st stage compressor components of T700 helicopter engines exhibit leading edge curl damage believed to be associated with high angle (60-90 degrees) and large particle impingement of erosive media. Decreased service life and increased maintenance costs occur as the realized time-of-flight is only half of that expected (2,500 hours vs. 5,000 hours). In some aggressive environments (like Iraq and Afghanistan), only about 100 hours of flight time (50 times less than expected) are achieved before significant maintenance is required to return the aircraft to flying status. The objective of this project is to better understand the leading edge curl phenomena, identify a duplex erosion resistant coating that survives high angle impingement of erosive media, and develop a manufacturing method / process for applying duplex or multi-layer erosion resistant coatings with improved erosion resistance over a wide range of large (>1mm) particle impingement angles (20-90 degrees).

Payoff

The anticipated cost avoidance for the SH-60B, SH-60F, and HH-60H helicopters was calculated based on the total number of engine removals to be avoided due to increase in mean time since engine removal associated with the improved configuration. Over a ten year period, the total cost avoidance is anticipated to be $20.5M.

Implementation

The final project goal is applying erosion resistant coating system to first stage compressor blisk (i.e., prototype hardware) to be tested at Naval Air Systems Command (NAVAIR) in an erosion rig. The performance goal of the coated prototype hardware is a minimum of 1000 hours of operation or a minimum improvement of 2X measured by time-on-wing. If the performance goal is met, Applied Research Laboratory (ARL) at Penn State University will continue to work with NAVAIR and MDS-PRAD Technologies to qualify the material system, manufacturing process and coated hardware. MDS-PRAD has significant prior experience with implementing coatings for T58 and T64 helicopter engines. This project is assisting in establishing the manufacturing capability to apply coatings to T700 engine blisks.

Cold Spray Aluminum for Corrosion Protection of Magnesium

A2138 — Corrosion Resistant Coatings for Magnesium Transmission Gear Boxes for SH-60

Objective

Main gearbox transmission housings are made of cast ZE 41 magnesium alloy. During operation, the magnesium alloy is subject to corrosion and wear damage. When damage reaches critical levels, the component must be replaced with a new component. The objective of this effort was to apply corrosion resistance aluminum coatings to damaged components and return them to service with enhanced corrosion resistance. The repair process was based on High Velocity Particle Consolidation (HVPC) or Cold Spray (CS).

Payoff

It is estimated that approximately 33% of the transmission housings that have gone through the repair facility have been replaced due to severe corrosion damage. The average cost of replacement is $20K per component, leading to total annual replacement cost expenditures of $4M. Approximately 60% of the scrapped housings can be recovered using the CS repair process. The cost of applying a coating to a housing is estimated to be $500. Anticipated cost avoidance is $2.34M per year. The repair of transmission housings will increase readiness by extending the life of the housings and reducing maintenance / replacement costs.

Implementation

Implementation will be accomplished at the Fleet Readiness Center (FRC) East at Cherry Point, NC. A coating system has been purchased through the Environmental Security Technology Certification Program (ESTPC) and is being installed at FRC East. The process for coating the SH-60 transmission housings will be fully transitioned to FRC East personnel.

PERIOD OF PERFORMANCE:

May 2006 to April 2009

PLATFORM:

REPTECH

AFFORDABILITY FOCUS AREA:

Not Applicable

CENTER OF EXCELLENCE:

iMAST

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STAKEHOLDER:

NAVAIR

TOTAL MANTECH INVESTMENT:

$750,000

Paint Application System to Increase Transfer Efficiency to 95% or Greater

PERIOD OF PERFORMANCE:

October 2006 to
September 2009

PLATFORM:

REPTECH

AFFORDABILITY FOCUS AREA:

Not Applicable

CENTER OF EXCELLENCE:

iMAST

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STAKEHOLDER:

NAVAIR
MARCOR
NAVSEA

TOTAL MANTECH INVESTMENT:

$180,000

S2176 — Effervescent Paint Application System

Objective

The application of maintenance coatings to ships, submarines, tanks, and other weapon systems is performed almost exclusively using the airless paint spray process. The transfer efficiency of the airless paint spray process is dependent upon a variety of factors but is generally accepted as being within the range of 40%-60%. Transfer efficiency is the ratio of coating solids deposited on a substrate to the total weight of coatings solids used in the coating application step, expressed as a percentage. The primary source of material loss during the airless paint spray process is due to overspray. The goal of this project is to develop a paint application system to significantly reduce or eliminate overspray from industrial processes and thereby increase transfer efficiency to 95% or greater. The process developed will be a paint spray application system having transfer efficiency in excess of 95%. This technology has been proven feasible through work performed at Applied Research Laboratory (ARL) at Penn State University.

Payoff

Reducing or eliminating overspray from these industrial processes will have the following beneficial outcomes: reduce material usage and the associated (potentially hazardous) waste streams; reduce volatile organic compounds (VOC) usage and accidental release of copper particulates during hull-maintenance activities; and reduce cleanup costs associated with paint overspray. The cost benefit analysis based on a single medium-sized shipyard using approximately 30,000 gallons of paint per year in the building and repair of ships results in estimated cost avoidance (materials and car detailing) of almost $600K.

Implementation

The prototype industrial paint spray system will be demonstrated at the Puget Sound Naval Shipyard in the 1st or 2nd quarter of FY09. Following successful demonstration the commercial paint system configuration will be finalized and a production unit will be fabricated. Once the final production unit has been tested and validated, implementation will proceed. Pollution Abatement Ashore (PAA) funding is being sought for implementation. Ample testing will be performed to identify reduction of overspray volume / improved material usage for various MIL - SPEC coatings. This spray system will operate and function in a similar manner to current airless spray systems. The only differences will be a reduction in overspray, improved material usage, reduction in cleanup costs, and reduced environmental impact. This spray application technology does not modify or alter the chemistry or physical properties of the materials being processed. For these reasons, no changes to specifications, standards, process instructions, etc. will be required. Implementation of this technology at DOD maintenance facilities other than Puget Sound Naval Shipyard will be accomplished through the simple expedient of purchasing a spray system, and applying current MIL - SPEC coatings to current weapon systems and support equipment.

Blade Repair Process Saves Up to $2.4M Per Year

A2177 — F402 Compressor Blade Repair

Objective

The project objective is to evaluate and implement a mature additive repair process and non-destructive inspection technique for the repair of high pressure compressor blade tips in the AV-8B harrier's F402 engine.

Payoff

The primary payoff is cost avoidance by repairing worn blade tips instead of replacing them. In addition, the original equipment manufacturer (OEM) of new blades has indicated that the Navy's demand for new blades will not be met due to manufacturing issues. The repair and inspection process will increase the operational fleet size and save up to $2.4M per year in operational costs associated with replacing blades. A successful repair process will impact other aero-engine systems such as the T700 and F-18.

Implementation

The outcome of this project will be a repair and inspection process for high HPC blade tips that provides flight assurance to the F402 Fleet Support Team (FST) and Fleet Readiness Center (FRC)-East, while reducing life-cycle maintenance costs and mitigating a future supply chain crisis. Implementation is achieved when (1) FRC-East acquires the equipment necessary to perform the repair and inspection process, (2) FRC-East produces qualification test samples according to the ManTech-developed Pilot Qualification Plan, and (3) the F402-FST and PMA 257 qualify the repair and inspection process. Final implementation is expected to occur in early FY10.

PERIOD OF PERFORMANCE:

March 2007 to
September 2009

PLATFORM:

REPTECH

AFFORDABILITY FOCUS AREA:

Not Applicable

CENTER OF EXCELLENCE:

iMAST

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STAKEHOLDER:

PMA 257

TOTAL MANTECH INVESTMENT:

$500,000

S2178 — In-Situ Strategic Repair Process

Objective

In many cases, significant cost savings can be realized if long-lasting component repairs can be executed on the ship or in the field. The goal of this effort is to develop and implement technologies that enable in-situ or field repair of various components for the Navy and other services. The primary short-term objective is to develop and implement in-situ clad repair tools and methodologies for main seawater (MSW) / auxiliary seawater (ASW) hull and back-up valves. This will be realized by developing a simple, flexible approach to clad repair that keeps the man-in-the-loop where appropriate and utilizes mechanization when justified. Development of such flexible techniques will pave the way for this technology to address a broader range of needs within the repair community. The strategy has been formulated based on feedback from the REPTECH Working Group, the Naval Undersea Warfare Center (NUWC) Keyport, and Pearl Harbor Naval Shipyard (PHNSY). The primary long-term objective is to identify other applications in which in-situ or field repair would result in cost savings, determine if a technology-based solution can help realize these savings and then develop new projects to implement the necessary technology.

Payoff

ASW / MSW valve repairs have been identified as requiring 3,390 manhours per vessel and were identified by the Navy Executive Planning Sessions as being a "Top Priority Improvement Candidate". Based on a 30% reduction in repair cost, the estimated cost avoidance for the Navy is $1.28M per year.

Implementation

The current plan is to develop a flexible repair tool for in-situ repair of ASW / MSW valves. The technical contact at PHNSY has already been engaged and has disseminated information about the project to groups that could be affected and has provided valuable information and photographs to allow a detailed definition of the issue. Both PHNSY and NUWC Keyport personnel have provided feedback on the plan and the approach. More recently, personnel from Norfolk Naval Shipyard, Portsmouth Naval Shipyard, and Puget Sound Naval Shipyard have been engaged, contacted, and visited. The approach is to define the problem in detail, develop conceptual flexible tools to address the problem, engineer suitable process heads and clamping systems, build a valve mock-up, and compare various cladding technologies. Concurrently, both NAVSEA 07 and 05M will be engaged to determine qualification requirements. Information gathered in this phase will serve as a foundation to enable teaming with commercial suppliers to build the required tools. Once these tools are successfully demonstrated and evaluated, they will be used to produce qualification parts. Upon qualification, the tools will be implemented at PHNSY and other shipyards.

PERIOD OF PERFORMANCE:

May 2007 to December 2009

PLATFORM:

REPTECH

AFFORDABILITY FOCUS AREA:

Not Applicable

CENTER OF EXCELLENCE:

iMAST

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STAKEHOLDER:

NAVSEA
Pearl Harbor Naval Shipyard (PHNSY)
NUWC Keyport

TOTAL MANTECH INVESTMENT:

$900,000

DOD ManTech
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Advanced Packaging Technologies Enable Smaller, Lighter, Lower Power, and More Rugged GB-GRAM Units

PERIOD OF PERFORMANCE:

May 2008 to August 2010

PLATFORM:

DOD ManTech

AFFORDABILITY FOCUS AREA:

Not Applicable

CENTER OF EXCELLENCE:

EMPF

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STAKEHOLDER:

US Army Global Positioning Systems

TOTAL MANTECH INVESTMENT:

$3,056,000

J2251 — Advanced Packaging Technology with Insertion into Defense Systems (APTIDS)

Objective

The Advanced Packaging Technology with Insertion into Defense Systems (APTIDS) project is expected to produce miniaturized Ground Based Global Positioning System Receiver Application Modules (GB-GRAM) units for implementation in military systems. This module demonstrates the application of advanced packaging technologies and techniques in both Radio Frequency (RF) and high speed digital modules to provide SWaP-C (size, weight, power, and cooling) solutions for DOD applications. Knowledge and practices gained through the APTIDS project will be provided to the DOD industry, thereby multiplying the benefits of a single project. Advanced packaging technology from the commercial sector will be leveraged to provide solutions to military electronics problems.

Payoff

The main benefits of this project are the provision of smaller, lighter, lower power, and more rugged GB-GRAM modules using advanced flip-chip technologies, micropassive components, high density substrates and interconnections, along with three-dimensional packaging (stacked dies and packages). Size reductions of the GB-GRAM, RF, and Global Positioning System (GPS) modules are anticipated to be 70%, 97%, and 76% respectively. The small, modular design will enable the rapid development and deployment of GPS in a variety of systems. Component standardization offers the potential for high volume GPS components to be used across DOD communications and weapons platforms. Decreases in cost of such systems, accompanied by significant increases in the technical readiness and manufacturing readiness levels, are expected as a result of this project. Improved anti-jam features will also be incorporated into these devices.

Implementation

The technologies developed as a result of this work will have wide ranging applicability to military programs. Under this project, small form factor Global Positioning Receiver and Radio Frequency modules will be developed. These elements will be combined to produce a prototype GB-GRAM module which will be tested to Army GPS specifications and compared to a module fabricated using standard manufacturing technology. At this point, a go / no go decision will be made concerning production at Rockwell Collins. Low Rate Initial Production (LRIP) will then produce GB-GRAM cards for qualification and acceptance of production units by the Army Product Manager.

Improved Manufacturing of Prosthetics Results in Reduced Cost and Increased Performance for Wounded Soldiers

J2256 — Prosthetics and Orthotics Manufacturing Initiative (POMI) Phase 1

Objective

The realities of the current military engagements are that more soldiers are surviving injuries and living with amputations. The capabilities of our care systems are strained by increased demands, not only in terms of sheer numbers of injured soldiers, but also in the extent of their injuries and the level of functionality expected post-injury. While the current care systems are providing excellent care, there are opportunities to improving processing and manufacturing of prosthetic systems to increase durability and comfort and to give medical personnel tools to aid in the care of injured soldiers.

The objective of the Prosthetics and Orthotics Manufacturing Initiative (POMI) project is to dramatically improve the quality and comfort of sockets for lower-extremity prosthetic systems by shifting away from the current experience-based design and production processes. This will be accomplished through several tasks. The first is the development of a detailed model of the residual limb and all soft tissue which will interact with the prosthetic system. This will be accomplished through medical imaging coupled to advanced tissue models. The second is the measurement of the dynamic loads placed on the socket through the use of a new sensor material which will be specially designed for this application. Accomplishing both of these will allow for intelligent design decisions, taking into account both load requirements and soft tissue reactions. The intelligently-designed socket will then be produced using an advanced technique – braiding -- developed for the aerospace and defense industries.

Payoff

Results of the project will enable prosthetists at military hospitals to produce intelligently-designed sockets which will be lighter and more comfortable for the soldier. By using automated processes, prosthetists will spend less time on socket production, freeing them to spend more time on actual patient care. Sockets will have longer service lives as well as reduced production and life-cycle costs (savings are expected to be approximately 25%). In addition, it is expected that the new technology will enable and extend socket use to the most extreme patients and activities.

Implementation

This effort will demonstrate a new manufacturing paradigm for custom sockets with spatially-variable properties to be produced with a high degree of automation, and with superior quality and will also produce sockets strong enough to withstand extreme uses, such as may be experienced by warriors returning to combat. These enabling technologies will be matured through the project and then transitioned to Walter Reed Army Medical Center.

PERIOD OF PERFORMANCE:

August 2008 to
August 2010

PLATFORM:

DOD ManTech

AFFORDABILITY FOCUS AREA:

Not Applicable

CENTER OF EXCELLENCE:

CMTC

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STAKEHOLDER:

Walter Reed Army Medical Center

TOTAL MANTECH INVESTMENT:

$2,900,000

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